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ORIGINAL ARTICLES

THE DYNAMICS OF THE NEW ANGLE MECHANISM, AS OBSERVED BY A NON-ANGLE MAN*

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THE necessity of making orthodontia a true science and an art was realized by that genius, Dr. Edward H. Angle, because of the great prevalence of malocclusion exhibited in the entire civilized world of his day. He was the first man who realized that if orthodontia was to become worthy of the name of a science, it must have the whole and undivided attention of those who were to practice it successfully, and with this idea foremost in his mind, he became the first man to organize a postgraduate school of orthodontia, not founded for profit but a school where orthodontia could be taught to those who were willing to spend the time and energy required to learn what was then known of this subject.

A review of the earlier records shows that this truly great man, like all of the truly great, had his opponents. For we all know, in order to avoid criticism, one must *be* nothing, *do* nothing and *say* nothing. But Angle was not of this kind, he *was* something, he *did* something and he *said* something. Therefore he was criticized, and sometimes unjustly so.

However, his most severe critics must all admit that he never prostituted his school for profit, that he always worked for the ideal, he was a great enthusiast, which is a necessary requisite for a great teacher. He was a real student, and an observer, which is evidenced by his classification of occlusal malrelations, and his memorable book, "Malocclusion of the Teeth," although written prior to 1907, contains much that has not been improved upon, and little that has been disproved since its publication.

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I do not wish to convey the idea that orthodontia has not progressed since the publication of Angle's seventh edition, nor that there have been published no other good books on this subject, for there have been several, some of which have been written by members of this Society and which have contributed much to our stock of knowledge.

It is possible that orthodontia has progressed more in the last thirty years than in all the rest of its previous history, and this in no slight measure, has been due to Angle, and the stimulus he gave to his students and others by his

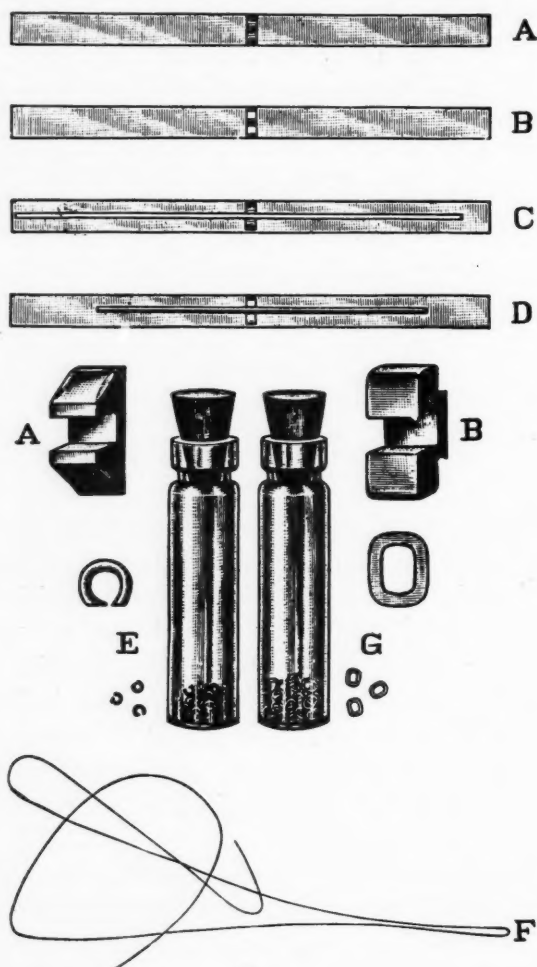


Fig. 1.

enthusiasm in this, *his chosen field*. He wrote no less than thirty-four papers on this subject, and a textbook which went through seven editions and which is today a much valued reference work.

He devised several types of orthodontic appliances, the labial alignment wire with friction sleeve nut, and the pin and tube appliance; then realizing the need of an appliance with qualities necessary to "push, pull and twist," he proceeded to make the ribbon arch mechanism, and finally what he terms the edgewise mechanism with the tie bracket bands, a system capable of positive control in three dimensions.

It is upon the dynamics of this last appliance that your committee requested me to read a paper, and no one realizes the genius of Angle more than I whose humble attempt to describe this appliance falls short when compared to the effort of Angle in his paper, "The Latest and Best in Orthodontic Mechanism."

Most men who are enthusiastic are unconsciously apt to overstress a point by exaggeration, and particularly so in order to emphasize the importance of something which may be little understood, or may not be realized by many, and here I am of the opinion that Angle is no exception to the rule, but certainly he was not wilfully so, for there is but little that I cannot most enthusiastically endorse regarding his claims for this new mechanism.

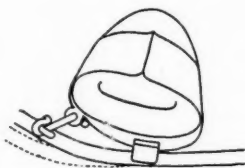


Fig. 2.

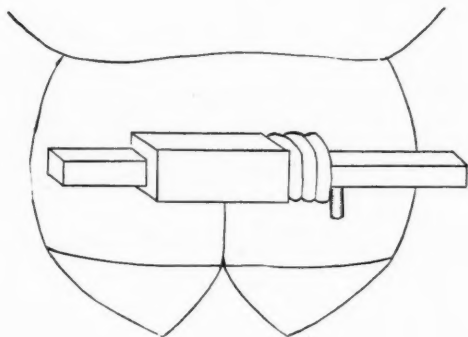


Fig. 3.

But wherever I may differ, it is a matter of personal opinion and with no malice, for I know of no orthodontist whom I appreciate and respect more than the late Dr. Edward H. Angle, to whom we owe so much.

The principles of application, construction and operation of this mechanism will be considered later, but let us pause for a moment to examine the various parts, which when assembled form this mechanism known as the edgewise arch with tie bracket bands. I prefer to call it the horizontal ribbon arch, in contradistinction to the vertical ribbon arch, commonly known as the ribbon arch.

Fig. 1 illustrates all the various parts of this new mechanism, with the exception of horizontal ribbon arch and the rectangular sheath. A shows a band of noble metals one-eighth inch wide, $1\frac{3}{4}$ inches long, and 0.004 inch in thickness, with a bracket brazed (or more commonly known as hard soldered) to its center on the labial surface. The bracket is made from a solid block of metal and has a slot cut horizontally across it midway of its length,

this slot measuring 0.022 in width, and 0.028 in depth for the reception of the horizontal ribbon arch whose dimensions are 0.022×0.028 . The outer ends of the bracket are beveled from the slot to the edges of the band; the bracket is designed especially for use on anterior teeth, and is called the alignment bracket or open faced bracket.

B shows another band of the same dimensions but having another type of horizontally slotted bracket. The positions of the bracket, above and below the horizontal central slot instead of being beveled as in *A*, form two wing-like projections for the reception of the ligature wire which is to secure the alignment wire into the horizontal slot in the bracket bands.

C and *D* show the two types of bracket bands seated within the brackets of which are segments of two types of elastic gold arch material, of which the arches are made, the form of arch used to be determined according to the requirements of the case at hand. The one shown in *C* is rectangular in form and measures 0.022×0.028 and most accurately fits the slots in either type of bracket.

That illustrated in *D* is round and measures 0.022 in diameter and is also made of elastic gold alloy. Therefore the two types of arches, round and rectangular are interchangeable in the two types of brackets (*A* and *B*).

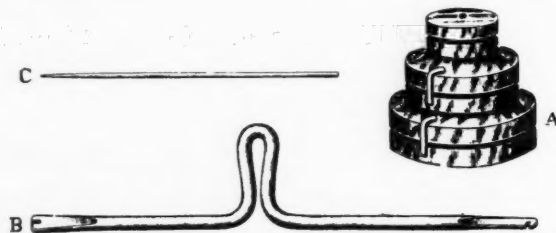


Fig. 4.

This horizontal ribbon arch when used with these alignment and tie bracket bands is more delicate, possesses more expansive power under certain conditions, and has a greater range of elasticity, a quality very much desired in correcting the curve of Spee and in bringing teeth into their correct upright axial relations, than other types of alignment wires containing much more material than does this new appliance.

E shows minute staples of precious metal to be attached by solder to the bands, arches or what you will, for a more perfect control of tooth movement.

By soldering these minute rings or staples to the bands in certain definite positions, we can attach the band to the alignment wire by means of a ligature, the ligature having a double function of securely holding the arch within the slot of the bracket, and at the same time exerting force through the staple which is soldered to the band, and thereby effecting the movement of the tooth as shown in Fig. 2. These staples or rings are made of platinum gold alloy. I prefer to make them of Aderer No. 4 wire of 0.015 in size, a material which will withstand any heat necessary to unite the band and the staple. Dr. Angle recommends two sizes of ligature, 0.010 and 0.015 inch brass wire. I have found these to be very clumsy, also that they tarnish very readily, and

I much prefer Wipla Ligaturendraht, now obtainable in this country under the name of Nichrome wire, which is very strong and can be used in small sizes, preferably 0.008 inch.

Fig. 1 *G* illustrates minute washers 0.025 inch in thickness. They accurately fit the rectangular arch, and can readily be used on the round 0.022 arches. They are used in extending the metal arches or alignment wire as illustrated in Fig. 3, in place of the usual screw and nut.

For this purpose they are slipped on the end of the arch wire, of either the round or rectangular variety, and form an extension or bearing between the horizontal buccal tube on the molar anchor band, and the spur which is soldered to the alignment wire.

Fig. 4 *A* illustrates the arch former, an instrument necessary in shaping the edgewise arches. If we should bend edgewise metal of ribbon form in a regular manner, it is liable to crimp or buckle, hence the necessity for bending it in an accurately fitting groove on a round or circular mandrel as illustrated. With this instrument one can produce a perfect edgewise bend.

Fig. 4 *B* illustrates a form of key wrench, flattened at either end and ac-

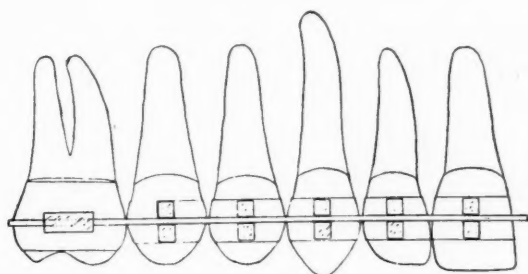


Fig. 5.

curately grooved to receive the 0.022×0.028 rectangular wire, and is used for making short bends as will be explained later.

C represents a fine tungsten needle for use in teasing or for applying the ring or staple and holding it in position while being soldered to the bands or other attachments. It seems almost unnecessary to describe the band technic before this Society, for both Dr. Angle and Dr. R. H. W. Strang have done so in a most admirable manner, but this is of so much importance that I feel it should not be overlooked, hence I shall quote from both in describing this technic.

"One of the most important things to learn is the correct positioning and formation of the bands upon the individual teeth. These must be so located that when tooth alignment is completed each bracket will be seated upon the arch wire, and this will be practically unmodified in the horizontal plane except as is necessary to produce such depressions, elevations or axial modifications as are demanded by treatment. Fortunately we have a very accurate gauge to follow in locating these bands. Fig. 5. On the incisors and canines they should be placed in the middle third of the crown of the tooth, and the operator can judge this closely because in such a location there will be just as much enamel exposed gingivally to the band as there is occlusally to it. It is

well to mark this area with a lead pencil before forming the band, and thus accuracy will be assured. On the premolars and deciduous molars, their adjustment is such that there will be about one thirty-second of an inch of the occlusal edge of the band overlapping the mesial and distal marginal ridges of these teeth, in order to assure stability of the bands against the occlusal force." (Quoted from Strang, "A Study of the Angle Edgewise Arch Mechanism.") When the standard band as furnished by the manufacturer is of insufficient width to permit this overlapping, I use a seamless premolar band

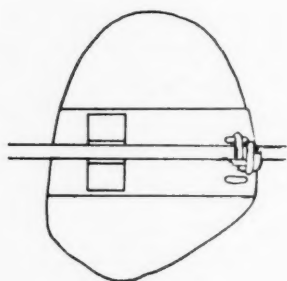


Fig. 6.

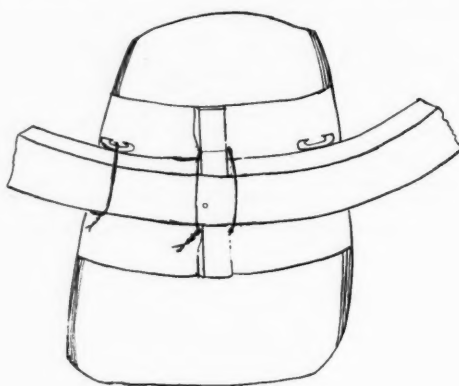


Fig. 7.

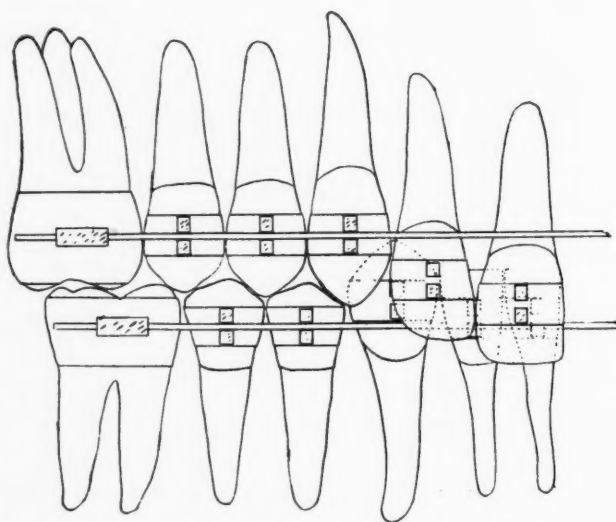


Fig. 8.

and solder the bracket to this band at the desired position. The location of the bracket or slot is an important factor. From the esthetic viewpoint, it is better that they be in the center of the labial surface, but the practical or the efficient position takes precedence, e.g., if a tooth is to be rotated the bracket must be placed nearest the more prominent angle and a staple soldered to the bands at the opposite angle as illustrated in Fig. 6. However, if there are no rotations to be made or all have been accomplished, the operator should endeavor to place all brackets in the center of the teeth (Fig. 7), in the direction of the long axis of the teeth.

In Fig. 5 you will observe that the tie brackets are all practically in a plane, thus reducing the amount of variation in the horizontal to a minimum, and by the manipulation of the horizontal edgewise arch wire within the bracket bands, teeth can be readily elevated, depressed, or axial relations changed, thus rendering it unnecessary for the further use of bite planes, in the correction of the overbite in certain cases of malocclusion as shown in Fig. 8.

We shall now proceed with the making of the alignment wires, as shown in Fig. 9, and here I do not follow the procedure advocated by Angle and many others. For example, to quote from Angle, page 14, "The Latest and Best in Orthodontic Mechanism":

"Now how is the proper shape of the metal arch to be determined? There are in dentures five points or 'landmarks,' so to speak, from which the ideal—the typical—form of both dental and metal arches may be quite accurately

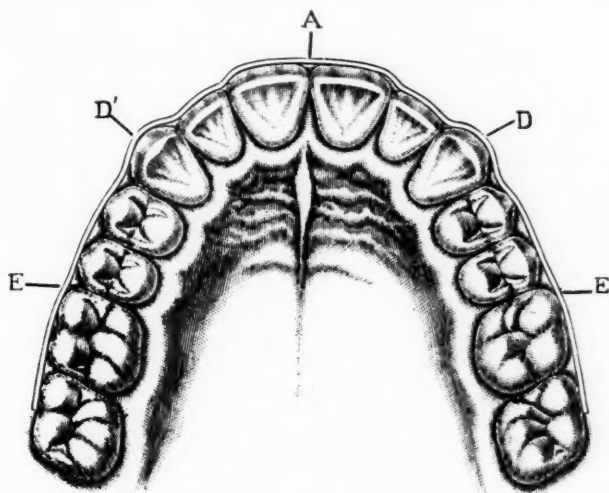


Fig. 9.

determined, regardless of the irregularity of position in which the teeth may be found. This at least is possible to him who can interpret the mechanics of the denture and relate the types of the teeth to the type of the individual. These landmarks are indicated at A, D, D', E and E' in Fig. 9 which is a drawing representing the ideal arrangement of the teeth in a fairly average normal upper dental arch, with a metal arch lying in juxtaposition to the teeth at the points of their proximal contacts.

"It will be noted that there is a straight line from the center of the labial ridges of the cuspids, D, D', to the center of the mesiolabial ridges of the first molars, E, E'. This line is *always* straight, regardless of the degree or form of the curve of the anterior part of the dental arch or of the lateral width between either the cuspids or the molars of the halves of the arch; this width, of course, always varying according to the type of the individual, that is, as the widths of the incisors intervening between the cuspids and the typical curve of the individual arch vary."

This part of Dr. Angle's paper I cannot agree with, and I offer for your inspection photographs of models and surveys of them to refute Angle's contention on this point. Two models are from the collection of Dr. H. Kelsey, three from the collection of Dr. J. Lowe Young, and three from Dr. Hellman's collection of normally occluded cases, seven of which we know were never treated but assumed their shape and form by normal physiologic develop-

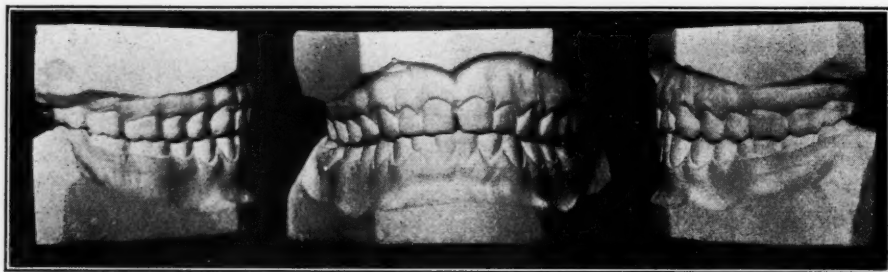


Fig. 10.

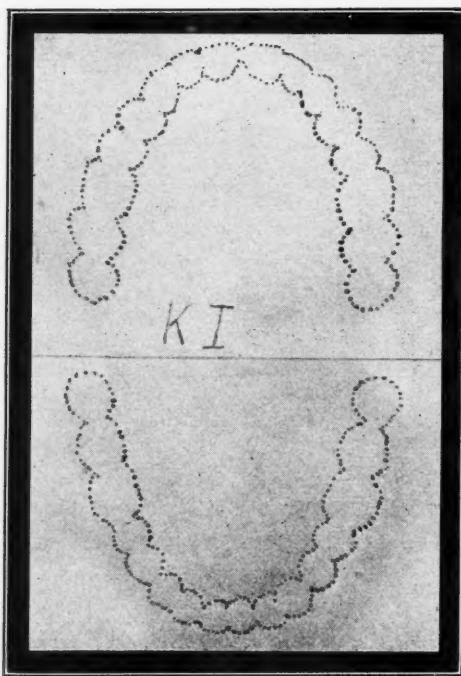


Fig. 11.

Figs. 10 and 11.—Case I K is from Dr. H. Kelsey.

ment, that is, without orthodontic interference, while the ninth is a model and chart of the Secretum Apertum, a skull owned by Dr. R. Summa.

I do not wish to convey the idea that I am entirely opposed to Dr. Angle's concept of ideal typal arch form, but Hellman has proved that investigation of extensive collections of anatomic material reveals the fact that the best dentitions do not correspond to the conceived abstract ideal. Therefore for this reason I do not think that the buccal teeth must be aligned upon a straight line running from the center of the labial ridge of the canines to the

mesiolabial ridge of the first molars, for I find this more the exception than the rule, and have shown you some evidence to prove this statment.

Also I am of the opinion that Angle has overemphasized the lingual position of the lateral incisor. It is a fact, however, that the lateral incisor is thinner labiolingually and that it is much shorter than the central incisor, which makes it less prominent than the central incisor or the canine, but I do not think it should take such a retiring position as one would imagine after reading Angle's paper.

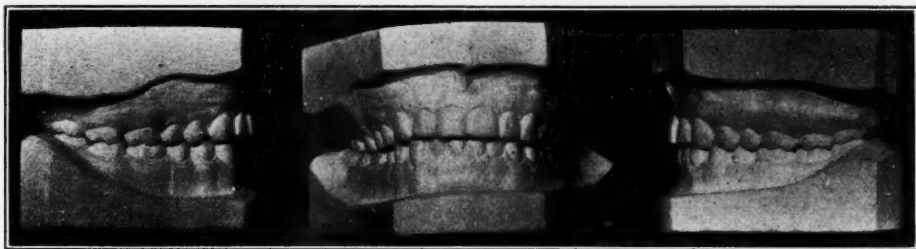


Fig. 12.

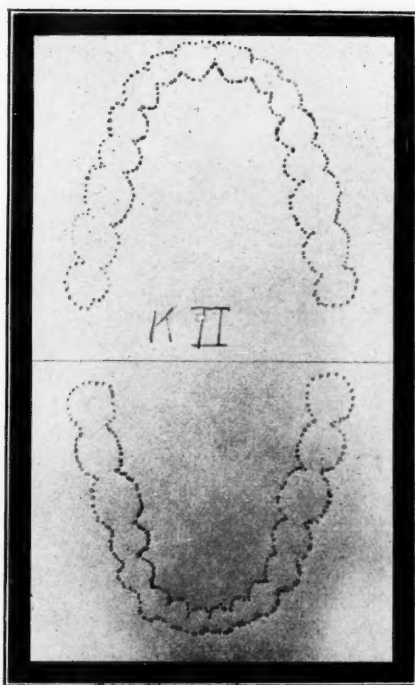


Fig. 13.

Figs. 12 and 13.—Case II K is from Dr. H. Kelsey.

However, this is only a difference of opinion and possibly of no great importance, for they will ultimately assume their best functional relationship in spite of what we all may think.

You will observe that my criticism of Angle's arch form is not severe, for I agree with him in the main, excepting in the extremely retiring position of the lateral incisors and the final arrangement of the maxillary premolars and first molar being on a straight line.

In shaping the metal arch, I measure the width of the incisors and the canine teeth, and to this I add 0.010 of an inch which represents the thickness of the band when cemented in position. I then mark off on the piece of 0.022×0.028 elastic gold material the width of the central incisor, the lateral incisor, and the canine, plus 0.010 of an inch for each tooth, then I mark the

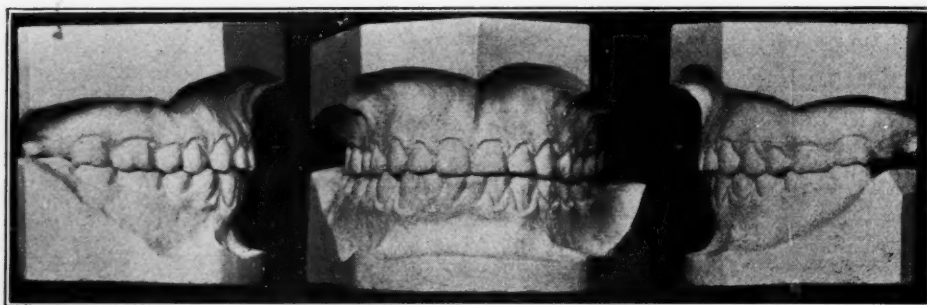


Fig. 14.

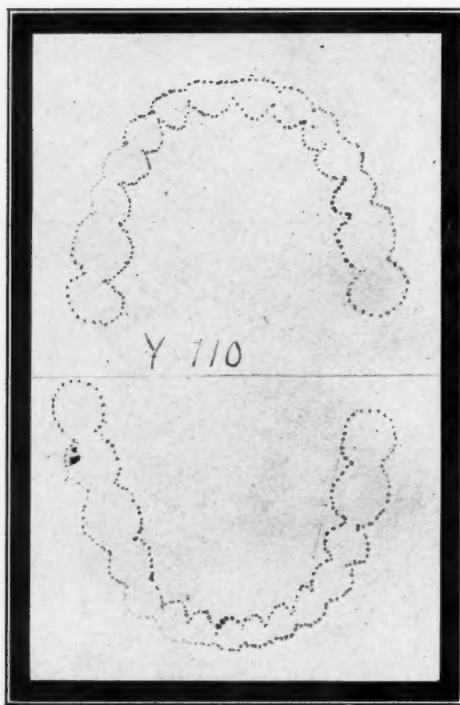


Fig. 15.

Figs. 14 and 15.—Case Y 110 is from Dr. J. Lowe Young.

position of the labial ridge of the canine, and proceed to bend the arch as described by Angle, Fig. 26, using a Hawley arch chart as a guide for a more symmetrically formed arch wire as shown in Figs. 27 and 28.

Fig. 27 shows a drawing selected by Dr. Angle as representing the ideal arrangement of teeth in a fairly average normal maxillary denture, upon which is superimposed a Hawley chart of 0.96 size, you will see how closely it approximates the ideal arch form of Angle.

Fig. 28 is the same drawing with a Hawley chart of 1.04 size superimposed on the same and shows how closely the metal arch will conform to Angle's ideally formed arch wire and being about four sizes larger than the Hawley arch predetermination for this case.

With this symmetrically formed arch wire as a base as shown in Fig. 29, I proceed to widen, narrow, and modify its shape to conform to my own pre-conceived idea of what the arch form for this particular case should be.

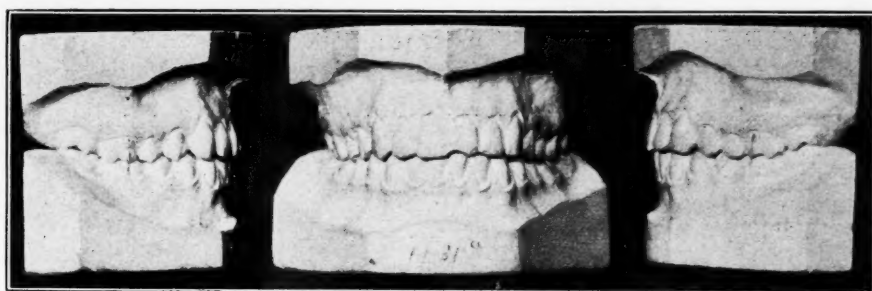


Fig. 16.

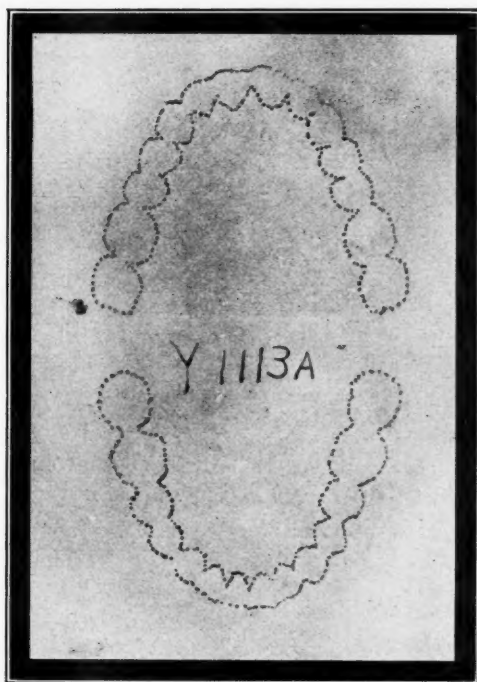


Fig. 17.

Figs. 16 and 17.—Case Y 1113A is from Dr. J. Lowe Young.

For narrow dentures I am guided somewhat by Hawley arch form and for wider cases by the Pont Index, but not necessarily adhering very closely to either, but using judgment, always considering the typical patterns of the teeth, the type of the face and skull and the general type of the individual, which I think is the method most in use as a guide in determining arch form for any given case.

With the arches now formed to our preconceived idea of form let us now consider tooth movement. Dr. Angle has divided these movements into three types or orders. Movements of the first order comprise those of labial, buccal and lingual, also movements for the elongation, depression, and rotation of teeth. The first three can be accomplished with or without bracket

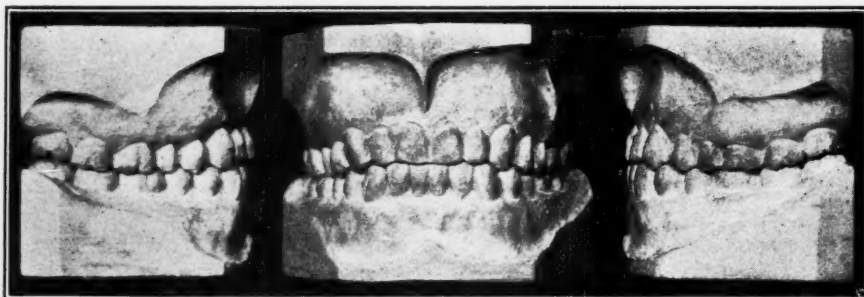


Fig. 18.

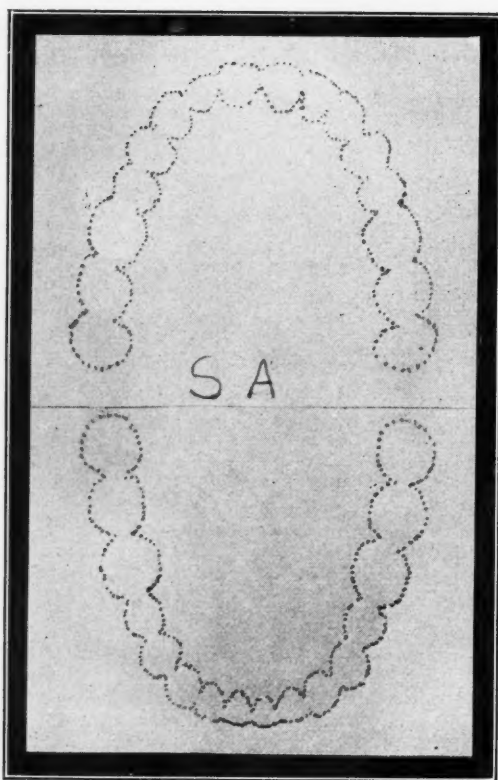


Fig. 19.

Figs. 18 and 19.—Case S A is from Dr. J. Lowe Young.

engagement, but the last three, namely elongation, depression, and rotation, should all have bracket engagement for a more positive control of tooth movement.

Fig. 30 shows the position of the brackets, staples and ligature for double mesial rotation and for the mesial movement of the two central incisors. When these incisors have been brought together and the torsion corrected by

rotation, they should be in their true axial relation if the band construction has been correct, because the arch wire fits perfectly within the brackets, and the latter have been soldered to the bands, parallel to the long axis of the teeth. Therefore the teeth must be at right angle to the alignment wire.

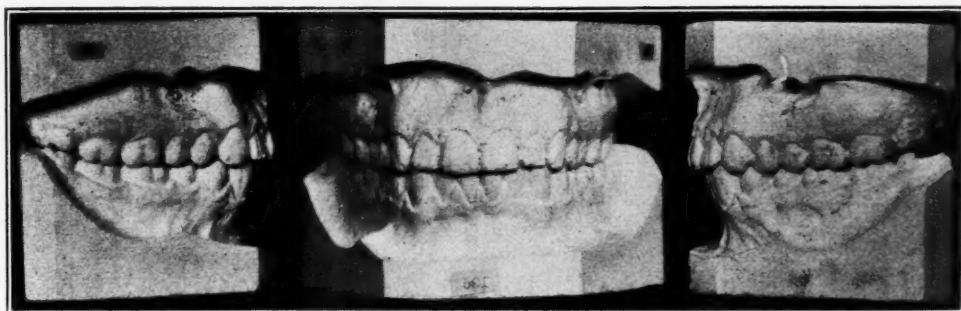


Fig. 20.

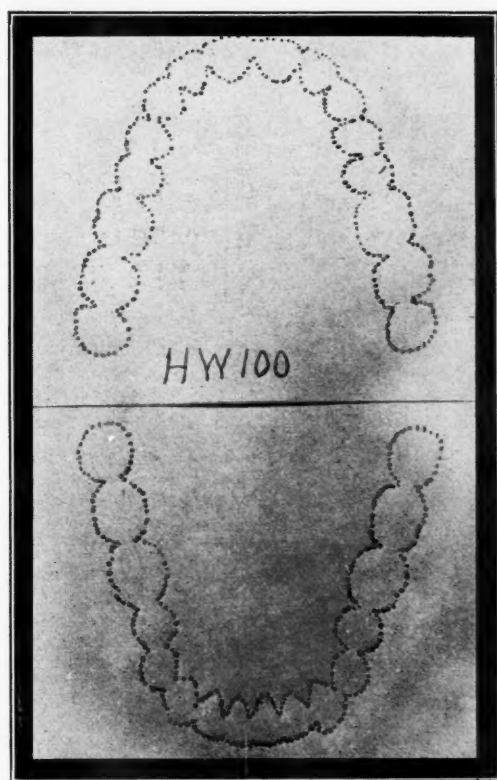


Fig. 21.

Figs. 20 and 21.—Case H W. 100 is from Dr. H. Hellman.

Movements of the second order of tooth movement are the mesial or distal tipping of the crowns and roots of the teeth. In the vast majority of distoclusion and neutroclusion cases that are complicated by dental or alveolar dental protraction, the maxillary molars and premolars have drifted forward and are not in their correct axial position, but sloping forward, and these cases exhibit a deep overbite sometimes attributed to lack of development of

the osseous tissue supporting the molars and premolar teeth or sometimes showing a supraversion of the maxillary and mandibular incisors.

It is necessary in most of these cases to change the axial positions of some or all of the teeth, and here is where Angle's second order of tooth movement can be applied with amazing results in a short space of time if desired.

For this order of tooth movement Angle offers two methods for its accomplishment, in the one as illustrated by Fig. 31 he adjusts the arch in such a

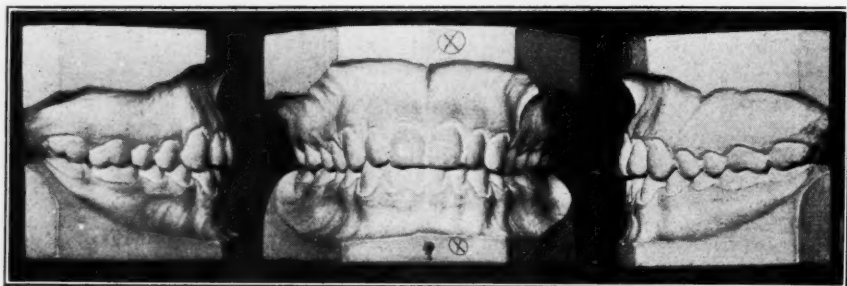


Fig. 22.

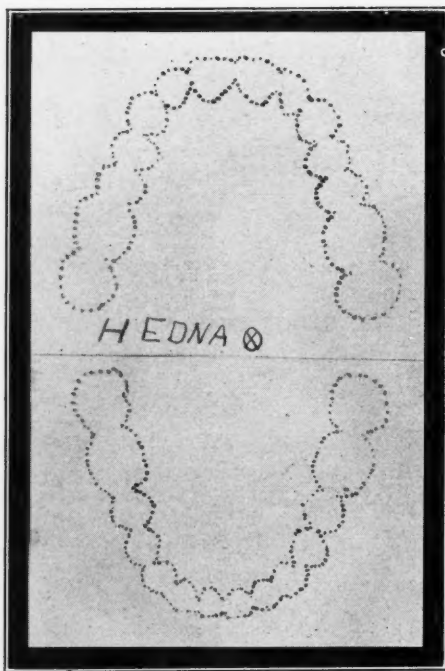


Fig. 23.

Figs. 22 and 23.—Case H Edna X is from Dr. M. Hellman.

manner as to cause it, when seated, to bind in the brackets and sheaths and to exert power favorable to this end.

To accomplish this point he makes compensating vertical bends in the arch wire, anterior and posterior to the bracket so that in this position the arch lies within the slot of the bracket and is slightly oblique to the long axis of the metal arch. Thus the force of the tempered arch should exert equal

pressure gingivally on the distal end of the gingival wall of the bracket, and occlusally on the mesial end of the occlusal wall of the same.

His second method of enlisting force for the uprighting or distal tipping of the crowns of the teeth is to change the position of the brackets on the bands, thus changing the angles of relation of the slots of the brackets to the long axis of the teeth, as illustrated in Fig. 32.

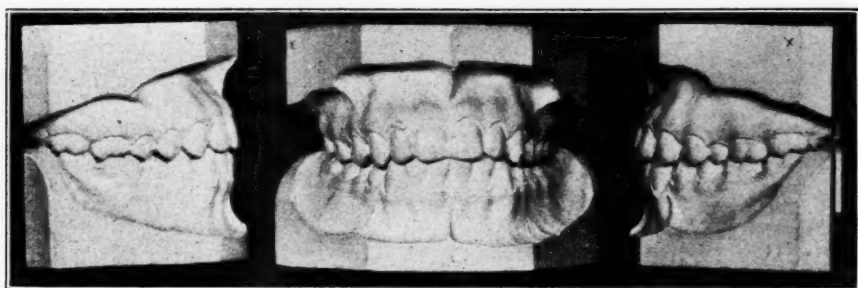


Fig. 24.

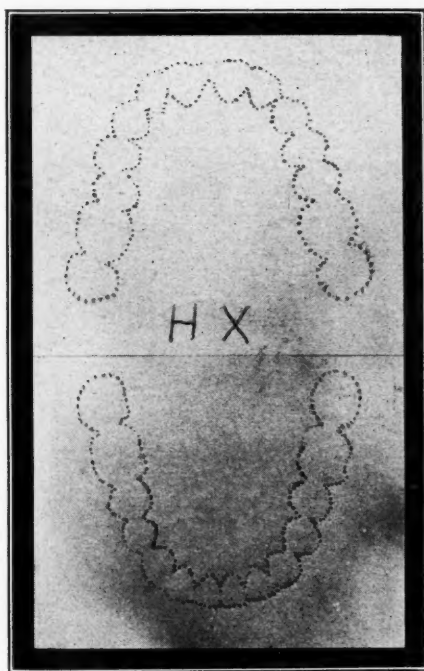


Fig. 25.

Figs. 24 and 25.—Case H X is from Dr. M. Hellman.

I enthusiastically endorse these methods advocated by Angle when they are needed, but I am of the opinion that it is not always necessary to secure such upright axial positions in all cases. I much prefer to band the teeth so that the bracket is placed in the center of the labial surface in the direction of the long axis of the tooth, and by weaving a light, well-tempered, round arch wire into the slots of the brackets, force is applied which will begin to upright the teeth. Then with a gradual step up from an 0.018 round wire to

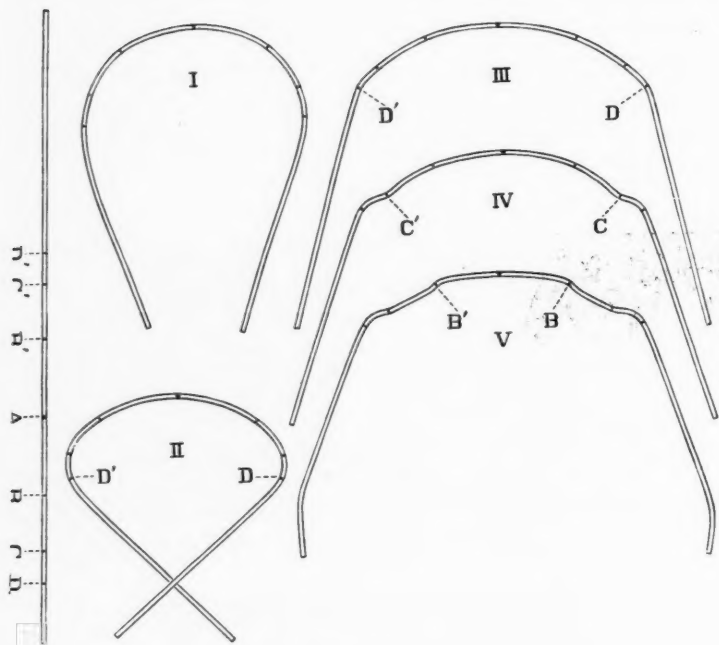


Fig. 26.

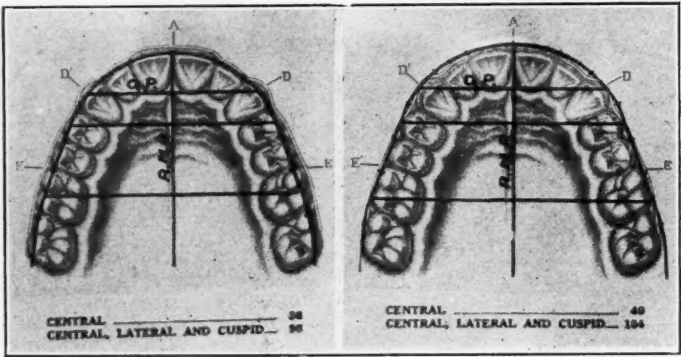


Fig. 27.

Fig. 28.

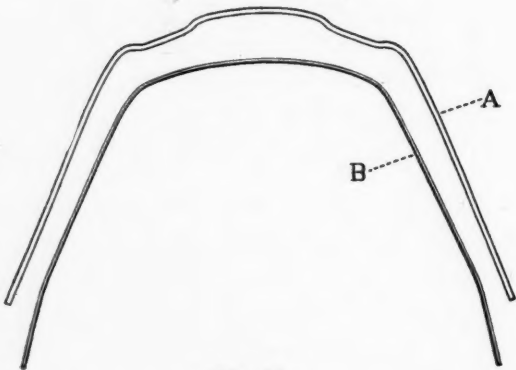


Fig. 29.

a 0.020 round wire, then to a 0.022 round wire the malposed teeth may be aligned with a minimum amount of inflammation, and a maximum efficiency of control of force through this gradual evolution, with the final seating of the 0.022 \times 0.028 edgewise arch.

Should this fail to produce the correct axial position, I prefer to use the latter method as described by Angle, namely, changing the angle of attachment of the bracket to the band, and keeping the alignment arch free from



Fig. 30.

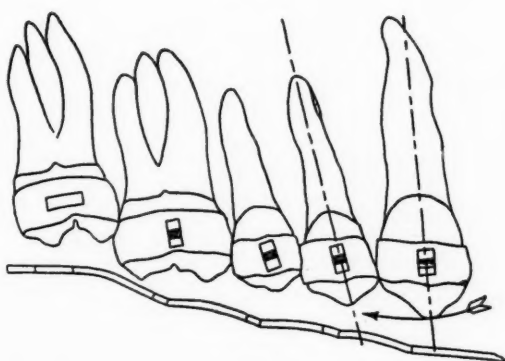


Fig. 31.

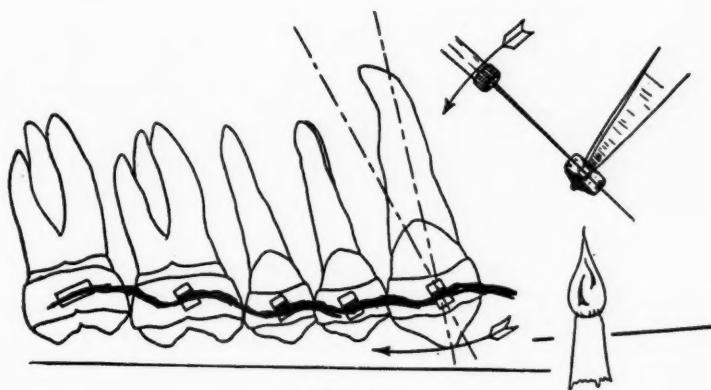


Fig. 32.

bends, in order to use intermaxillary elastics or occipital anchorage, or both, for the bodily distal movement of the teeth whenever this is desired.

Before dismissing the dynamics of the second order of tooth movement we should consider the position of the buccal tube to be attached to the molar band for anchorage purposes. Unquestionably proper anchorage is essential for the efficiency of the appliance. To criticize Angle's molar bands would be trite, but in my opinion, the use of a seamless molar band properly swaged, fitted, and contoured is far more superior.

The position of a 4 mm. rectangular tube or sheath is of vast importance. It should be so soldered to the band that it will be parallel to the occlusal surface of the tooth and not produce a torsional twist when the horizontal ribbon arch has been seated within it.

Angle's third order of tooth movement is that of torque. It is that force or power that is derived by slightly twisting the metal arch in some part or parts thus storing energy in the arch, which when liberated tends to untwist or torque on itself in the direction of its long axis.

We should not lose sight of the fact, "That where there is an action, there is always an equal and opposite reaction." Fig. 33 illustrates simple torque for one tooth. You will note the twist at A. This can be made by

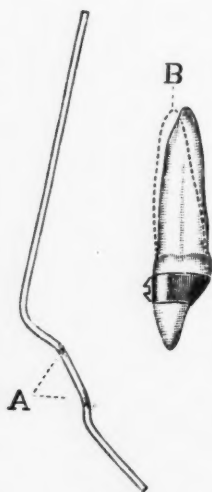


Fig. 33.

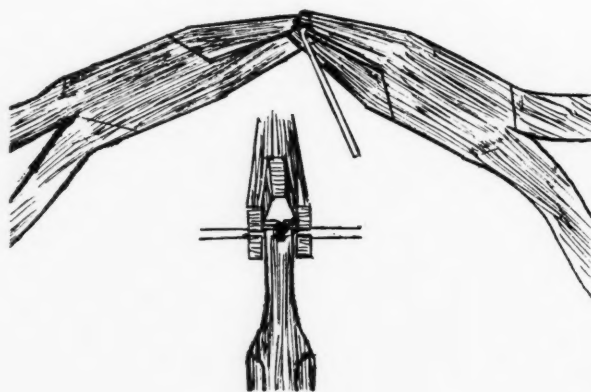


Fig. 34.



Fig. 35.

holding the arch firmly within the double beaks of a pair of pliers, having a slot 0.022×0.028 for the reception of the arch wire and by grasping that portion of the wire which lies between the two beaks with another pair of pliers also having a groove or slot 0.022×0.028 cut transversely across its beak, torque may be applied as shown in Fig. 34.

The use of torque for individual tooth movement I think is an admirable technic, but I see no reason for its use as an aid for arch expansion as advocated by Dr. Angle, who while discussing torque says, "It also has another very important and practical application, namely, that of reinforcing the usual power derived from the lateral spring of the metal arch, for widening or narrowing the dental arches," . . . "by tipping or rolling the molars or premolars out of their vertical positions by a perpendicular rotating force."

Thus one can see that torque as applied here, is nothing but a tipping of teeth from their vertical position in a buccal or lingual direction requiring two steps, first the torque and second the detorque.

When an increased width is required, torque is an unnecessary movement, because expansion can be accomplished far better with the use of a

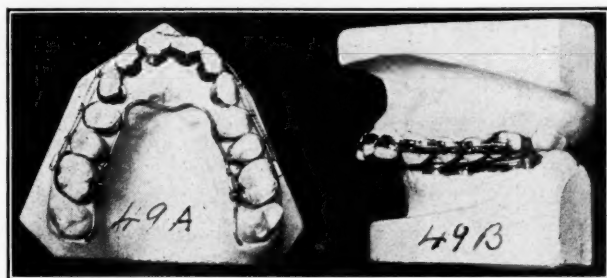


Fig. 36.

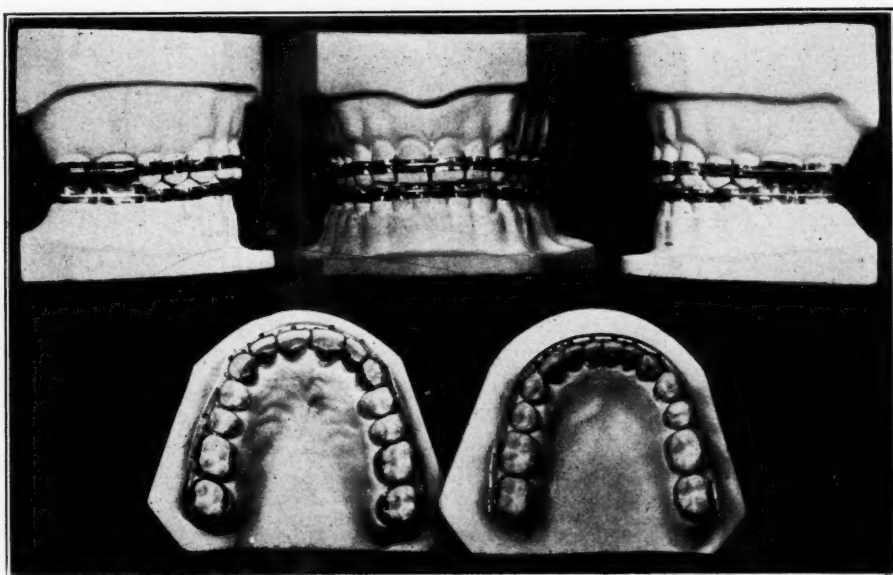


Fig. 37.

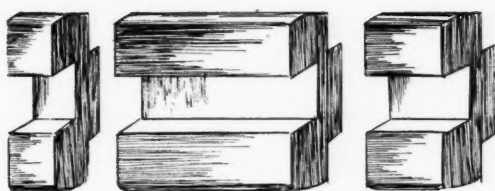


Fig. 38.

modified lingual arch wire as illustrated in Figs. 35 and 36. This is made by soldering a piece of platinum gold wire 0.050 at right angles to the lingual surface of the molar band, upon which fits a small tube whose external diameter measures 0.090 and 0.065 long, this ring fits snugly over the round post. The tube is soldered to an 0.036 lingual arch. The locking of this appliance

is accomplished by the ligating with a piece of wipla wire, from the lingual arch wire, to a small ring which is soldered to the buccal surface of the molar band, and augmented by a spur soldered to the lingual surface of the right and left first premolar bands, which help to hold the lingual arch up to its work.

With this type of lingual arch, the second order of tooth movement is not inhibited, and the axial angle changes and buccal bodily movement can be accomplished simultaneously.

After a careful study of Angle's method one can readily see that he has practically constructed the perfect appliance. One is capable of applying this technic advantageously in almost all types of malocclusion.

Fig. 37 shows the correct position of all the component parts of the horizontal ribbon arch. This model also presents an added feature, that of using the second molar as the anchor tooth, with the large bracket soldered to the first molar band. With the use of this technic, excessive overbite and curve of Spee treatment is greatly facilitated.

The use of the three sizes of brackets as illustrated in Fig. 38 also can be used effectively, and I sincerely hope that the manufacturer of this appliance can be persuaded to make them an integral part of the mechanism.

Though this appliance is by no means automatic, the acquiring of the mechanics and skill in manipulation will enable an operator to accomplish any desired tooth movement with more positive control.

Furthermore, in conclusion, I repeat that the more I use the new appliance, the more I appreciate the genius, Dr. Edward Hartley Angle.

DISCUSSION

Dr. F. B. Noyes, Chicago, Ill.—There is very little in the paper that I find to criticize. It has been beautifully presented and shows the component parts and the method of use of the appliance. Anything that I say in criticism of it is in minute and rather unimportant details.

The first thing that I do criticize in the paper is a tendency so common that I think it should be avoided with great care. There has always been an inclination for men to change the names that were used by the men who first developed or introduced some method or appliance.

I am thinking of the term "cell." This word was introduced many years ago to describe the unit of living organism. It was not very long before men studying biology realized that whatever the cell was, it was not a hollow space surrounded by walls, but still that term has remained and I believe will probably always remain as the name for the unit of life. Black named the periodontal membrane which supports the tooth, and now we have half a dozen names for it, perhaps etymologically some of them better, but all of those complicating names are a disturbance to the student and to the teacher.

I realize, I think, what was in the mind of the essayist in calling this arch the edgewise and ribbon arch, but Dr. Angle studiously avoided it, and I think it is a mistake to use another name for it. I think so particularly because of the fact that in my own use of this appliance and in the use of it by others, I have seen the commonest mistakes occur in transferring to this appliance the philosophy of the ribbon arch. Most of my mistakes I could attribute to carrying over to this mechanism the philosophy of the previous one. A little later I shall return to this point.

The essayist uses different material for the staples. I do not see any objection to this. Personally, I have never found any difficulty in soldering the staples that was not easily overcome.

Before Dr. Angle died, the nickel chrome metal had come in, and he was using both the wire ligatures and the stainless steel ligatures. They each had advantages in some places, but I think more and more we shall come to the use of the nickel steel and the stainless steel wire ligatures in certain types of tooth movement.

With reference to the width of the band on the premolars, a wider band is being manufactured and will very soon be on the market. Most of the men who have used this have found that the band is not quite wide enough to allow the carrying over of a slight margin which should, as the essayist points out, be a slight margin on the occlusal surface of the premolars; these slightly wider bands, however, are now in the process of manufacture.

We shall always find differences of opinion in regard to the ideal arch form. There is one thing, however, that I want you to think carefully about, particularly in the formation of graphs, and that is the necessity that the graph be made at the level of the bracket in order to be a guide for the arch forms. Whether that should be straight from the canine to the first molar will often depend on the position of your graph.

The essayist, I think, properly called attention to the common mistake of making the set-back of the lateral too great. He emphasized, as did Dr. Angle, the dental anatomical structure which makes this mistake possible; namely, the difference in labiolingual diameter of the centrals, laterals and canines. From this circumstance arises the fact that the bend should be made with the idea of its being made only in sufficient amount to compensate for the difference between the labiolingual diameter. As the essayist said, the lateral is not as thick and its functional surface is the lingual surface. Consequently, if we align the labial surface with the central and the canine, it will not be in its true position. The set-back for the laterals should be only the amount that its anatomical form requires.

Dr. Angle's technic for measuring the positions on the arch is obtained by measuring the distances after the incisor and canine bands are placed. Then you have the actual measurements to make when you make the allowances which the essayist advised.

There is, however, another factor which enters into consideration which no one has as yet found a method of estimating. A straight line is the shortest distance between two points, and in making those measurements or in allowing for them, as the essayist does, you lay this shortest distance out on a straight wire and when the lateral and canine bends have been made, you no longer have a straight wire and, consequently, your distances are not perfect. You must make allowance for the greater distance that is required after the conforming ideal arch form bends have been made. No one has yet figured any mathematical formula that will accurately give that increased distance along the length of your straight arch wire. It must be considered to give the arch its ideal form in its original adjustment.

The essayist referred to three orders of tooth movement. In Dr. Angle's presentation I think he does not have in mind three kinds of tooth movement, but simply three types of bends. He refers to three orders of bends in the making of the arch. The first order of bends gives it its ideal form; the second order of bends is concerned with the distal movement of the buccal teeth; the third order of bends is concerned with torque. Those, in Dr. Angle's mind and in his idea of the technic, referred to the bends of the arch which of course do have relationships to two tooth movements, but I believe it is much better in thinking of this appliance to confine those three orders to the bends rather than to relate them to the three types of tooth movement, because they are not always strictly related to those types of movement. That is just a suggestion for your thinking in regard to this technic.

The lingual accessory does not seem to me to be necessary. The expansion of the arch is amply provided for in the mechanism itself, and I think the lingual accessory which the essayist has found useful is an added complication which need not be used, as the buccal movement can be obtained without it.

I do not quite understand his objection to torque. In my hands it certainly is an added and very effective means of obtaining certain types of movement with reference to width of arch. It accomplishes the desired results, which can be accomplished without it to be sure, but it accomplishes them more satisfactorily, more in accordance with biologic reactions and in shorter time. Consequently, I see no objection to its use and I think it is certainly an advantage which can and should be taken account of in obtaining the desired movements.

The only thing I want to say in discussing this paper is to supplement just a little what the essayist has said, by saying it in a different way. We all realize that in the accomplishment of tooth movement we are concerned with something more than mere mechanics. We are concerned with the relation of mechanics to biologic reaction, and there are certain things that are introduced in this mechanism which are so radically different from what we have had before that I think they must be considered in thinking of the dynamics of this appliance. Not that I mean the essayist did not think of them, but he did not emphasize them.

The more effective a mechanism is mechanically, the more perfectly it must conform to biologic reactions, and if it does not conform, the more damage it will do. Consequently the more perfect the efficiency of any appliance, the more thoroughly must the operator be grounded in the fundamentals of biologic reaction, and the more perfectly he must think in terms of those biologic reactions to the use of his mechanism.

I said a few minutes ago that the philosophy of the edgewise arch was radically different from that of the ribbon arch. I have been forced to this conclusion by my own experience with the two. In much of what I shall say in the next few minutes I shall perhaps exaggerate in order to make my points more clear, but the greatest difference between the ribbon arch and the newest mechanism, in philosophy at least, is that the ribbon arch still uses the principle of moving one tooth at a time or accomplishing certain movements of certain teeth, and then other movements of other teeth.

The newest mechanism radically differs from that philosophy in this respect: that it is acting upon the entire denture. You will have to think of that quite a while before you realize the extent of its truth. We might illustrate it by certain methods which we were obliged to use with the ribbon arch when we wished, for instance, to move all the buccal teeth distally, and then the incisors lingually. We tipped the molars distally and brought the premolars back to them, and then we moved the incisors lingually. It was necessary in the mechanics of that appliance. That is not true in the use of the present mechanism. It changes very radically all of our ancient conceptions of anchorage, for in the use of the newest mechanism every tooth is moving and every tooth is acting as anchorage. That requires very careful thinking both in terms of mechanics and in terms of biology.

We are only beginning to visualize what is happening in the denture during orthodontic treatment. Some of you know that for a great many years I have tried to make orthodontic students realize that the teeth are moving in three dimensions of space and not in two; that during the period of orthodontic treatment you have growth changes and movements going on. More than any appliance we have ever had this mechanism is dependent for its success on the visualization of these inherent growth programs. We are only beginning to formulate conceptions of the direction and extent of the movement of the teeth in the development of the denture, of the development of the face and its relation to the cranium, but all of those factors must be clearly thought of if this mechanism is to be used successfully and to the best advantage of the patient. Those are the factors which we must consider in the conception of the movement of the entire denture which we are desirous of accomplishing in the orthodontic treatment. I say again that this mechanism for the first time, from the beginning to the end of its application, enlists every tooth and they are all moving at the same time.

I have before drawn attention to the fact that this is the method by which malocclusions occur. Every orthodontist realizes the thing which is so difficult for dentists to realize, that when one tooth has erupted in a wrong relationship and a malocclusion has developed, every tooth in the denture has moved from its normal position, and in order to restore the denture to its normal they must all be moved. Those who do not understand this point usually want this tooth pushed back or pulled out.

Now, for the first time, our method of treatment corresponds to the method that has occurred in growth in the development of the malocclusion, namely, all the teeth from the beginning to the end of the accomplishment must be moved, and if properly handled the process can be so adjusted that this movement is not a movement based upon these wires; that is, it is not estimated by determining the shortest distance this tooth can be moved in

order to bring them all into alignment, a fundamental fallacy, but it is based upon moving the tooth toward the position from which it has drifted during the development of the malocclusion.

Let me repeat, then, that the edgewise arch differs fundamentally in its principle, and we must think clearly of the distinction which this imposes upon the technic. It enormously emphasizes the necessity for clear understanding of the fundamentals which are the basis not only of the production of malocclusion but of the basis of its correction, and still more fundamentally the basis of the preservation of a normal relation when once established; for no matter what appliance is used in bringing teeth into normal occlusion or into normal relation, we can never lose sight of the fact that the teeth remain only in the position in which all of the forces to which they are subjected are in balance. Recurrence is almost always due to the fact that some forces are still unbalanced or that some details in the arrangement of the teeth allow that disturbance of balance to become effective again.

The essayist very nicely showed the dynamics of moving buccal teeth distally. I want to emphasize that, however, in one way which I think was not quite strongly enough emphasized in the paper. Biologically, the position of greatest growth is at the border of the alveolar process. If you think of what is to happen to the molars and premolars simply as a change of axis, that change of axis may be accomplished in two ways. The end of the root may remain stationary and the crown tip distally, or the crown may remain stationary and the root tip mesially, and in either case the axis will be brought into normal relation. In the first case you will have accomplished what was desired in the orthodontic movement, and in the second case you will have made the case worse than it was in the beginning. It is not the purpose, then, simply to end-up those teeth, to bring them into axial relation to each other, that we are seeking to accomplish.

In the development of the malocclusion the crowns have drifted mesially, but the roots are in their normal position, much more normal at least than the crowns. In the correction you are desirous of tipping the crowns distally, leaving the roots alone.

It is just as easy to do the wrong thing as it is to do the right thing in the use of this mechanism. If the wrong thing results, the case is made worse. The great mechanical advantage in this appliance is due to the fact that the crowns can slip along the arch, but again I want to warn you that the slipping of the crowns along the arch will not accomplish the desired end alone, and the incisors must come lingually just as far as the crowns of the buccal teeth tip distally, and at the same rate of speed, if the accomplishment is satisfactory. If the incisors remain stationary, or if the canine does not move at the same rate as the premolars and the molars, the result on the premolars will be that of throwing the apices of the roots mesially and the crowns will remain in the same position.

The appliance, therefore, is far from foolproof. It is certainly easy to do the wrong thing with it, and we must think accurately in terms of our biologic response if we are to get the results. That is why I emphasized a minute ago the fact that the greatest growth is at the border of the alveolar process. It is much less active at the apices of the roots. Consequently, the use of the correctly thought-out mechanics enables us to use the apex of the root as the fulcrum and tip the crowns distally and have little or no change in the position of the end of the root.

I have found from experience, however, that the opposite can occur. For that reason, we are more dependent perhaps upon the proper use of our intermaxillary rubbers at the proper time in treatment than even with the previous mechanisms, and failure to use intermaxillary force in the proper amount and at the proper time results in very serious detriment to the patient.

On the other hand, we have perhaps in the past been a bit uncertain in our own minds as to the effect of intermaxillary rubbers, so that when the patients said they had worn them and the tooth movement made us believe they had not, we found after a little experience with this mechanism that we could be absolutely sure and could face down any patient or any parent when doubtful. If the crown movement desired is not resulting it is because the forces which you have indicated to be used are not being used. Do not forget, however, that failure to use the rubbers at the proper time in some of these treatments will produce a result which it is exceedingly hard to overcome.

There is one other consideration in contrasting this arch with the ribbon arch that I want to emphasize. In using the E arch the arch was conformed to an approximation of the ideal form desired and the attempt was made to bring the teeth to conform to this. In the ribbon arch the arch was conformed to the malpositions of the teeth and they were brought to it only by changes in the form of the arch. This is then a fundamental difference between the ribbon arch and the newest mechanism, for in the newest mechanism Dr. Angle returns to the original concept of an elastic arch in the ideal form, bringing the teeth to it; not bringing them to it one by one, however, but bringing them to it by exerting force on all of them from the beginning of the performance.

Dr. Glenn F. Young, New York.—When starting to use this mechanism, I used the alignment brackets on the anterior teeth as advocated by the late Dr. Angle, thinking the tie bracket bands would be very irritating to the lips. Such has not proved to be the case, so I now practically never use the alignment brackets. I do find, however, that the alignment brackets are indicated on mandibular anteriors where there is a deep overbite.

I cannot agree with the essayist's statement that the horizontal ribbon arch possesses more expansive power under certain conditions than do other types of alignment wires, if by that, he means that a dental arch as a whole can be widened more efficiently, as I have found that practically all of the other movements will take place more rapidly than the widening of an arch when the horizontal ribbon arch is used. Dr. Waldron advocates the use of a lingual appliance in conjunction with the horizontal ribbon arch, which does not interfere with the efficiency of it, and I very heartily agree with him in this.

I think it would be more nearly correct if Dr. Waldron had said "establishing the curve of Spee" instead of "correcting the curve of Spee," as my understanding is the curve of Spee is the normal curve which needs no correction.

In quoting from Dr. Angle and Dr. Strang, the essayist mentions the overlapping of the bands over the mesial and distal marginal ridges of the premolars and deciduous molars to assure stability of the bands against the occlusal force, and he advocates the use of a wider band to secure this overlapping when necessary. I believe this to be a very dangerous procedure because it will interfere with the establishment of a normal occlusion and there is a great possibility of the cement being broken under the band, thereby loosening it and providing a crevice in which caries may originate.

Dr. Waldron has so nicely brought out the correct positioning of the brackets on the individual teeth that there is no need to go into that except to reiterate what he said concerning the placing of the bracket in the center of the labial surface in the direction of the long axis of the tooth, using a light round arch wire to start correcting the axial relation. If this is done carefully, I see very little need of the second order of tooth movement or for changing the angle of attachment of the bracket to the band.

Since the essayist has not chosen to do so, I should like to call your attention to the two auxiliaries which were advocated by Dr. R. H. W. Strang in his paper at a meeting of the New York Society in December, 1929, and which was published in the *Dental Cosmos* February, 1931.

The first is the vertical spring loop attachment used for opening spaces when occasion demands, due to the premature loss of a deciduous molar and the tipping mesially of the first permanent molar. Without this loop, there is such a severe strain placed on the first premolar band that it is difficult to keep it securely cemented. I am showing a slide to illustrate such a condition except that in this case the first permanent molars had been lost and the second molars have tipped mesially. The use of this loop decreases the strain on the band anterior to it and supplies a gentler pressure which will be effective over a longer period of time.

The second of these auxiliaries is the rotating spring, soldered on the gingival side of the arch, and curved in a U-shape gingivally, the free end being adjusted to exert pressure lingually. This type of spring is not so likely to be of use if the brackets and staples have been properly placed originally.

Now I should like to show another departure which we have made and have been using very successfully; the use of a hook instead of a staple. Of necessity a staple must be soldered gingivally, occlusally or incisally to the arch so that when ligated to the arch there is a binding force exerted. The hook is made of 0.018 spring wire, soldered directly in line with the slot in the bracket and extending as far interproximally as possible. This facilitates the engagement of the ligature and overcomes the tendency of the arch to bind in the bracket.

Another simple little device is a piece of tungsten wire, which is shaped to fit into the rectangular tubes to enable the operator to solder them on molar bands in the proper position.

CERTAIN CRITICAL STAGES IN THE EVOLUTION OF THE VERTEBRATE JAWS*

BY WILLIAM K. GREGORY, PH.D., NEW YORK, N. Y.
(*American Museum of Natural History*)

FIVE hundred million years or more were required by Nature to produce the human jaw, in the long successive periods from the earliest fish-like creatures up to man. But you may ask, "Why five hundred million years?" and "Why 'from fish to man'?"

As to the first question, after a century and a half of exploration and research, geologists and paleontologists find that in all the continents, North America, South America, Africa, Europe, Asia, Australia and Antaretica, the successive rock strata tell a consistent history of life through the ages. Each age has its characteristic assemblage of plants and animals, and when we view the picture as a whole, these assemblages fall into a historical sequence which is quite as well known as is the sequence of periods of written history in Europe.

Until recently all that was firmly established was the order of succession, not the length of time either of the successive chapters or of the period as a whole. It is true that tentative estimates had been made of the length of years of certain geological epochs, based upon the thickness of the rocks and the inferred rates at which rocks are now being built up by the rivers that deposit their loads of mud along the sea coast. But none knew better than the geologists themselves that such methods gave at best only a preliminary notion of the length of geologic time and that they could not cover the unknown periods represented by the unconformities or breaks between deposition periods, when the rocks were being worn down rather than built up.

During the past quarter-century, however, the physicists have been developing a method of estimating the ages of particular rocks, which promises eventually to give fairly accurate dates for a series of definite points in geologic history. To put the matter in a nutshell, the physicists found: (1) that ores containing uranium were continually giving off a graded series of radiations, including alpha and beta rays and radium rays; (2) that the uranium was gradually disintegrating into a peculiar form of lead; (3) that the lapse of time since the ore was crystallized could be estimated by measuring the ratio of the total amount of lead in the sample to the amount of uranium left in it; (4) it was further shown by many workers that uranium rocks that had crystallized at different periods of geologic time gave time estimates that were consistent with their known place in the geologic column; (5) finally, it was found that even when uranium rocks were subjected to excessively high or

*Summary of paper read before the Alumni Society of the Dewey School of Orthodontia at the Annual Meeting, October 28, 1930.

excessively low temperatures, to terrific pressures or to the stresses of very high electrical fields, they continued to give off alpha, beta and radium rays at the same rates as before. In other words, the rate of transformation of uranium into lead was not affected by any changes which the rocks would have been likely to encounter on or near the surface of the earth since the time of their crystallization.

Hence it appears that the estimates of the age of particular rocks furnished by the physicists are more reliable, more exact, than the earlier and quite provisional estimates arrived at by other methods. But it is also noteworthy that according to these newer time estimates the duration of the various chapters of the earth's history is from ten to twenty times greater than the older estimates.

Early in the past century English geologists divided the history of the earth as recorded by its surface rocks into the following main divisions: (a) the Archean and Algonkian eras, represented by very ancient crystalline rocks forming the so-called "basement complex" that lies beneath the sedimentary rocks in all continents; (b) the Primary or Paleozoic era of sedimentary rocks, including the Cambrian, Ordovician, Silurian, Carboniferous and Permian rocks and their corresponding ages; in the early part of this era only invertebrates are known; at its close we find in the ancient coal swamps of Pennsylvania the remains of air-breathing fishes and early forerunners of our salamanders and frogs; (c) the Secondary or Mesozoic era, including the Triassic, Jurassic and Cretaceous ages; during these ages the dinosaurs flourished while mammals and birds began their adventurous careers; (d) next follows the Tertiary or Cenozoic era, subdivided into the Eocene, Oligocene, Miocene and Pliocene epochs, often called the Age of Mammals and characterized by the dominance of the mammals; (e) finally we have the Quaternary or Psychozoic era; this embraces, first, the Pleistocene epoch of successive advances and retreats of the continental glaciers; during this period man emerges from the shadows of geologic time and gradually dominates the scene; the second division of the Quaternary era is the Holocene or Recent epoch, dating only since the retreat of the last major glacial division and not older than perhaps fifteen or twenty thousand years.

It is against this vast background of geologic time that we must picture the evolution of man from some early gill-breathing fish up through the successive stages of air-breathing, lobe-finned fish, newt-like amphibian, lizard-like reptile, egg-laying pro-mammal, insect-eating placental mammal, squirrel-like tree shrew, chattering pro-monkey, tailless pro-ape, talking ape-man, and self-conscious *Homo sapiens* (Fig. 1).

But what of the evolution of the human jaw? And even before that, what are the sources of our knowledge of its evolution? The fundamental assumption back of modern comparative anatomy is that at any given age of the earth's history the course of evolution was not equally far advanced in all members of a given zoological group, but that first there were a few primitives or hold-overs from a previous epoch living in a delayed or out-of-date stage of development; second, there were the average citizens, third, the progressives, and fourth, the freaks. It is by the comparison of these different grades of organiza-

tion that at any given period we can see any given organ, such as the jaw and teeth, in different stages of evolution in different kinds of related animals. The second source of our knowledge of the evolution of the human jaw is found in its individual development or embryology; the third source is in the study of the successive stages set forth in Fig. 1.

Taking it all in all, it is a long story, five hundred million years long at a conservative estimate. Nevertheless, the outline of this story is becoming so increasingly clear as the result of the labors of many geologists, paleontologists, comparative anatomists, embryologists and others that I have been able to condense it all into the accompanying charts, as a result of a fresh review of evidence from many sides, which I have been accumulating for the past thirty years. A host of investigators has made available the material on which these charts are based, and I can assure you that no one of these pictures is a figment of the imagination. Each and every one of these figures is based either on known fossil and recent material or, in one or two cases, upon the developmental stage of a recent mammal.

After this preamble the history of the human jaw, according to present evidence, may be summarized as follows:

I. The agnathous stage, in which the future jaws had not yet progressed beyond the stage illustrated in the lower paleozoic ostracoderms (Fig. 2 *A, B*) and in the larval stage of the modern lamprey (Fig. 2 *C*).

II. The primitive gnathostome stage (Fig. 2 *D, E*), in which the jaws had not progressed beyond the grade illustrated in paleozoic and modern sharks. Here the inner or primary jaws (Meckel's cartilage) are serially homologous with the branchial arches. The outer or sheathing jaws are represented only by the shagreen and tooth-bearing skin.

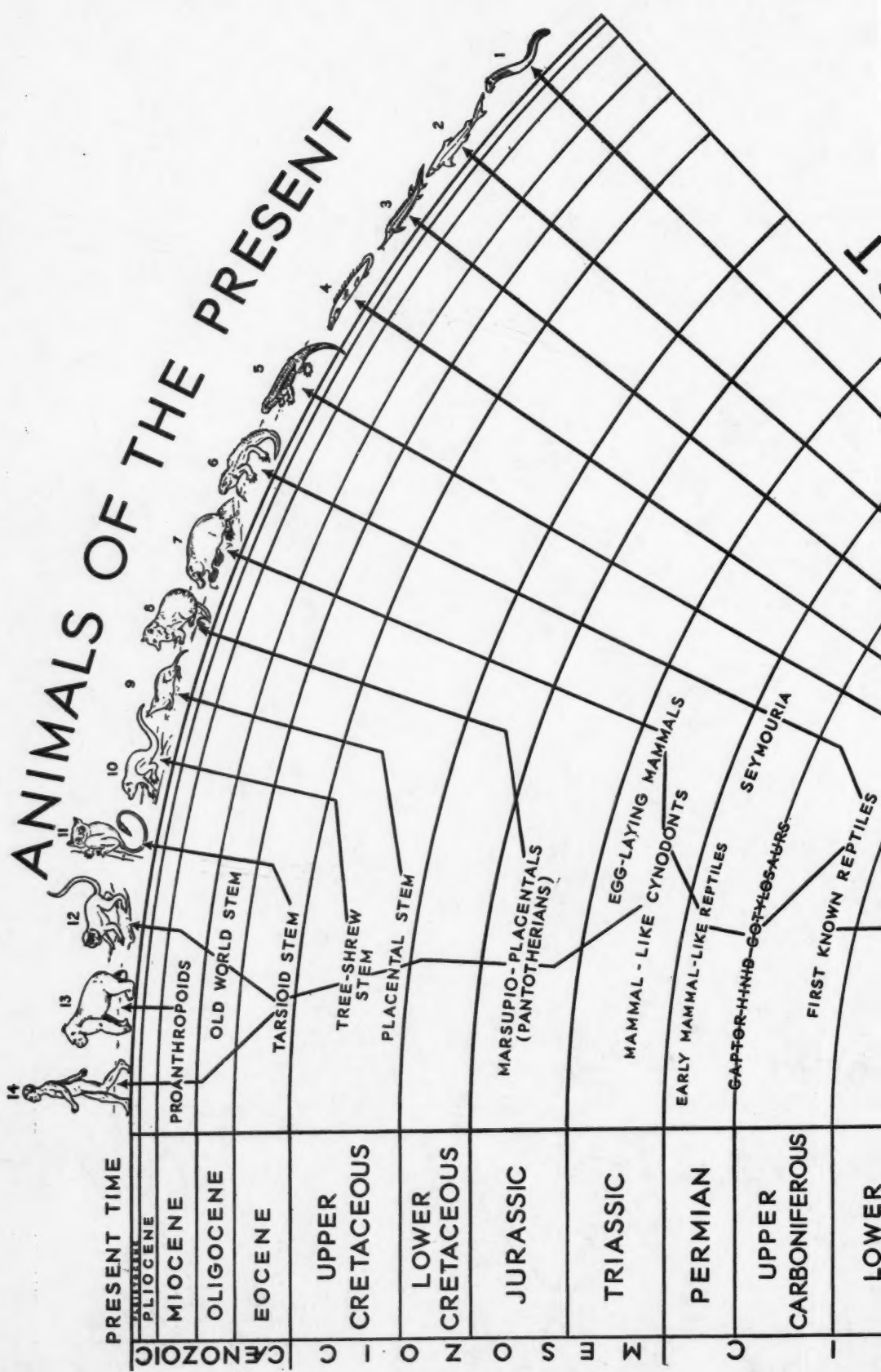
III. The complex jaws of lower vertebrates above the shark grade, including an inner or primary core and a sheathing of osseous and dentigerous plates (Fig. 3 *G*). This jaw articulates with the skull by way of the articular bone (art.) and of the quadrate.

IV. The mammal-like jaw of the higher mammal-like reptiles (Fig. 4 *E, F, G*), in which one of the sheathing plates, the dentary (*dn*) of each side, became much enlarged, while the elements behind the dentary became progressively diminished.

V. The typical mammalian jaw (Fig. 6 *A*), in which the dentary bone has established a new articulation with the squamous portion of the temporal complex, while the greatly reduced posterior elements, especially the articular and the quadrate, dwindle into the malleus and incus of mammals.

VI. After these profound changes had taken place, for which there is very convincing evidence, the subsequent evolution in the jaw in the primates (Fig. 5 *B-E*) involved chiefly the shortening of the horizontal part or body of the mandible, correlated with the reduction in the dental formula from $I_2 C_1 P_4 M_3$ to $I_2 C_1 P_2 M_3$; fusion of the opposite halves of the mandible at the symphysis, and

VII. Outgrowth of a chin and refinement of the jaw in the later human stages (Fig. 5 *F*).



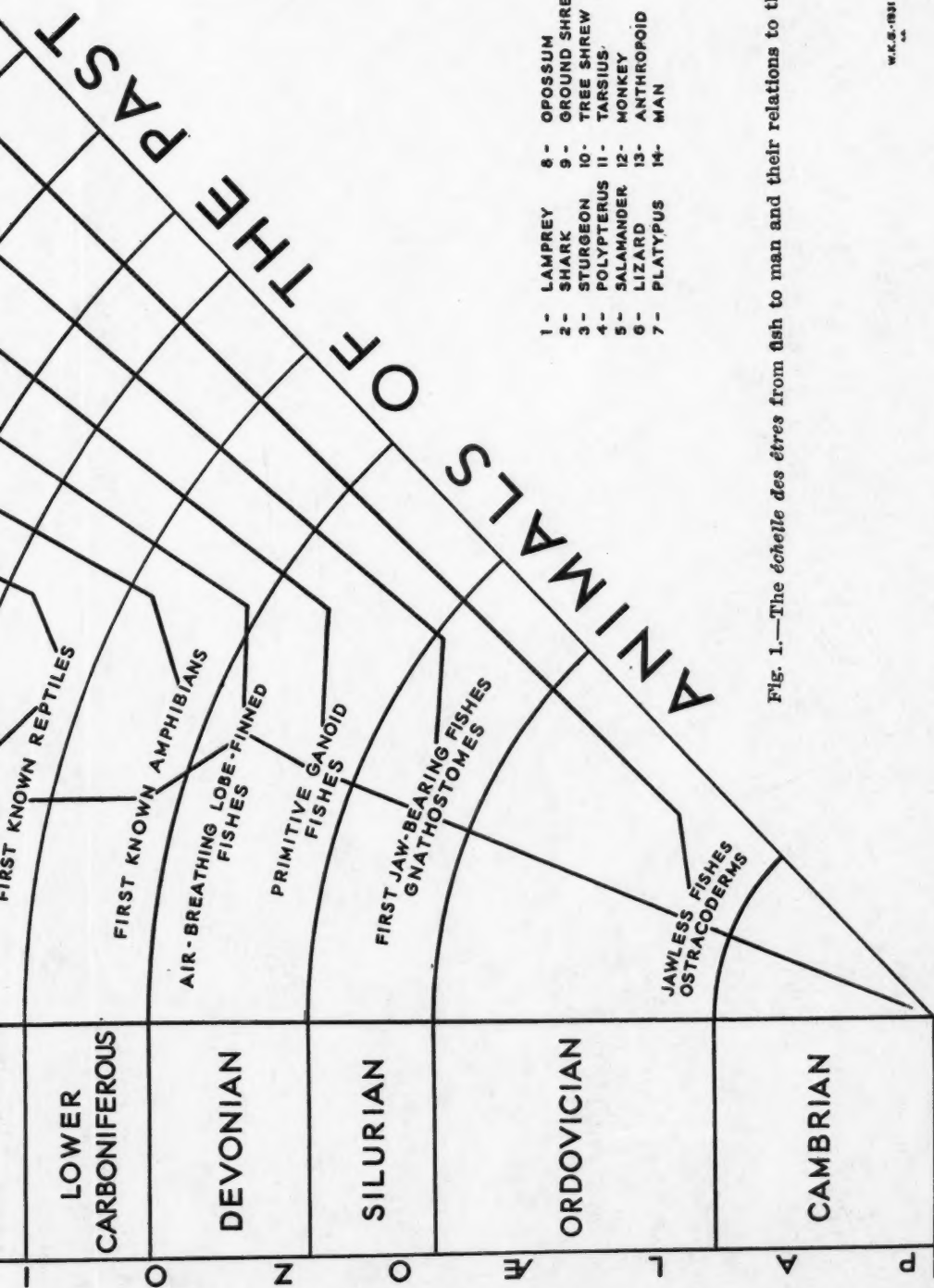
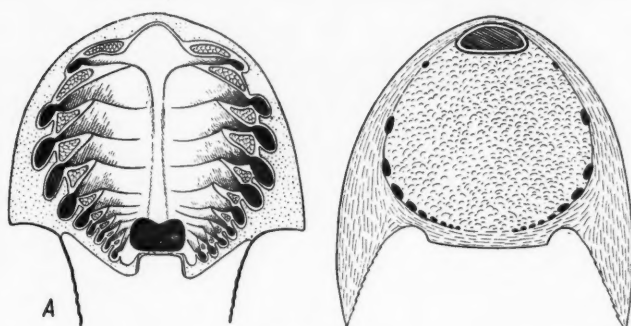


Fig. 1.—The échelle des êtres from fish to man and their relations to the fossil ancestral stages.

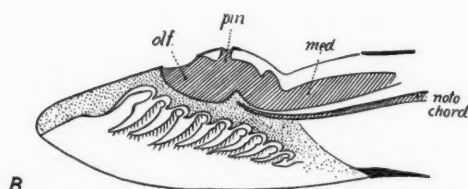
W.K.S.-1931
U.S.

AGNATHOUS STAGE

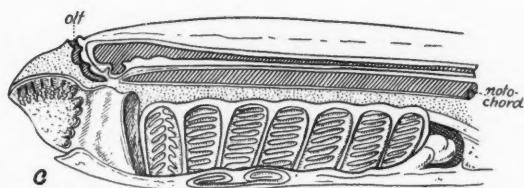


Ostracoderm

after Stensiö



B

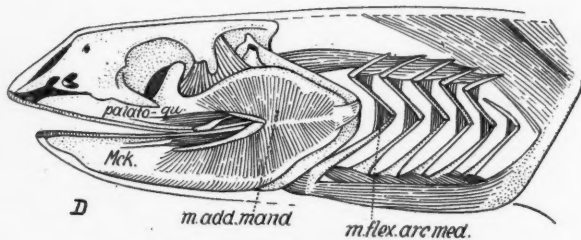


C

Petromyzon larva

after Parker &
Goodrich

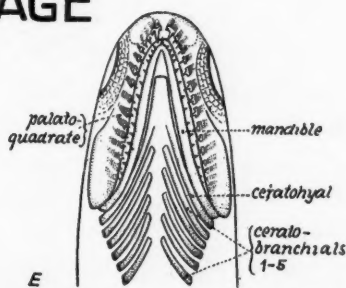
GNATHOSTOME STAGE



D

Primitive Shark

mostly after Allis



E

Devonian Shark after Dean

Fig. 2.—The beginnings of the vertebrate jaws.

Agnathous Stage.—A. Devonian ostracoderm. After Stensiö. The figure at the left is a reconstruction by Stensiö, from excellent material, of the roof of the mouth and under side of the head-shield. The future jaws are represented by the cartilaginous supports of one of the anterior gill slits. The right-hand figure is a tentative restoration by Stensiö of the probable appearance of the under side of the mouth, gill-openings and related parts of another ostracoderm. B. Thick sagittal section, after Stensiö, but with the position of the gills and gill bars indicated. C. Larval lamprey, sagittal section and inner side of branchial basket, showing agreement with ostracoderm in fundamental plan.

Gnathostome Stage.—D. Primitive existing shark (*Chlamydoselache*), data mostly from Allis; showing relations of primary upper and lower jaws to gill arches. E. Devonian shark (*Cladodus*); under side of head, showing jaws in series with branchial arches.

THE COMPLEX JAW INNER CORE AND OUTER SHEATH

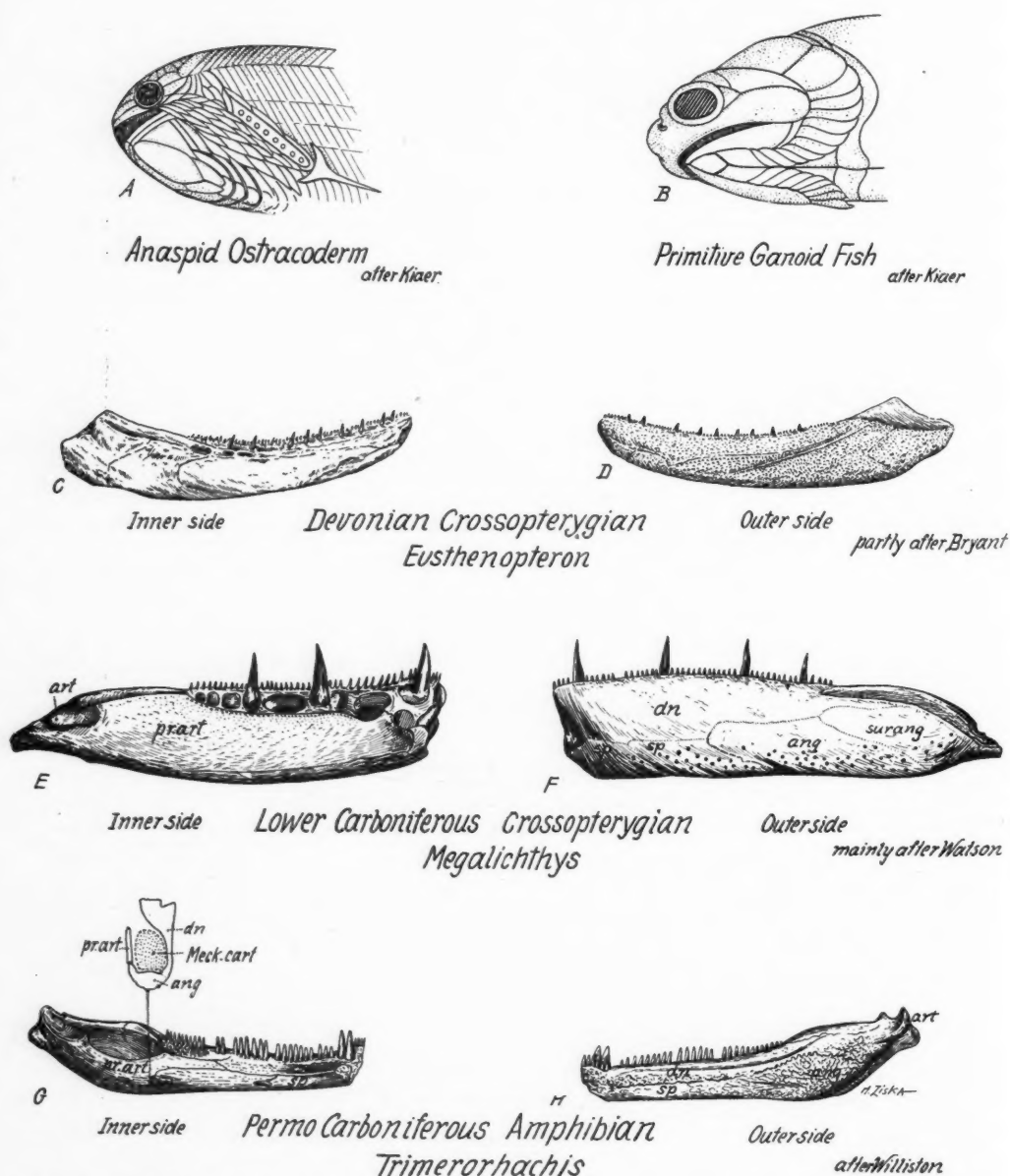
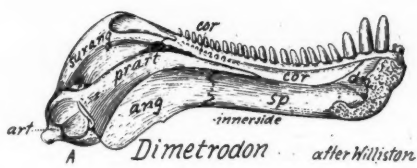
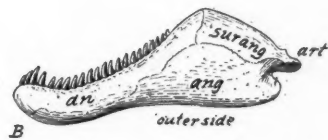


Fig. 3.—Early stages in the evolution of the complex jaw. Read from above downward.

PROGRESSIVE ENLARGEMENT OF THE DENTARY BONE

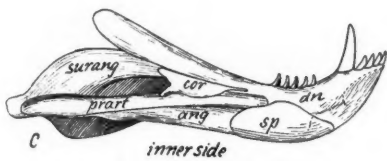


Dimetrodon after Millistone



Sphenacodon after Millistone

Primitive Theromorph Reptile

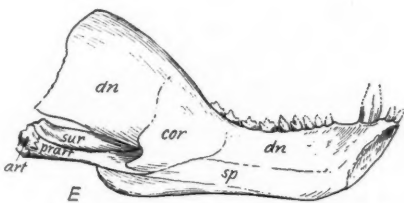


inner side

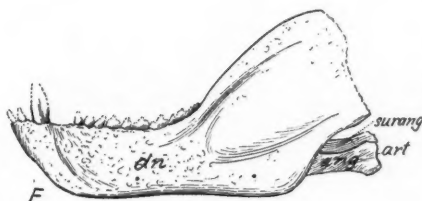


outer side

Primitive Gorgonopsian Cynarioides after Broom



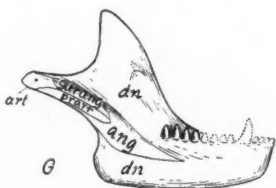
inner side



outer side

partly after Watson

Progressive Cynodont Cynognathus



inner side

Ictidosaurian

after Broom



outer side

Dromatherium after Simpson

Fig. 4.—Progressive rise of the ascending process of the dentary and reduction of the elements behind the dentary.

LATER STAGES
PROGRESSIVE SHORTENING OF JAW ETC.

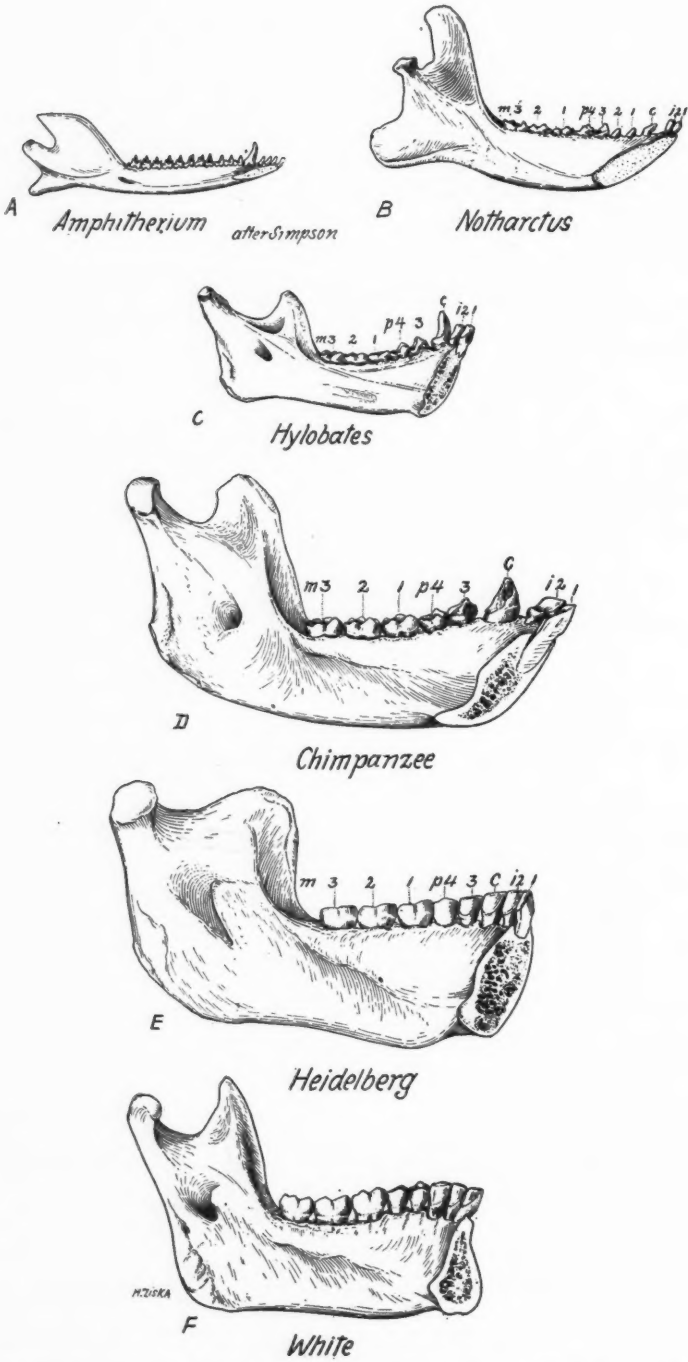


Fig. 5.—Later stages in the evolution of the "one-piece" jaw. Medial aspect of left half of mandible.

FORMATION OF DENTARY-SQUAMOSAL CONTACT AND INTER-ARTICULAR DISC

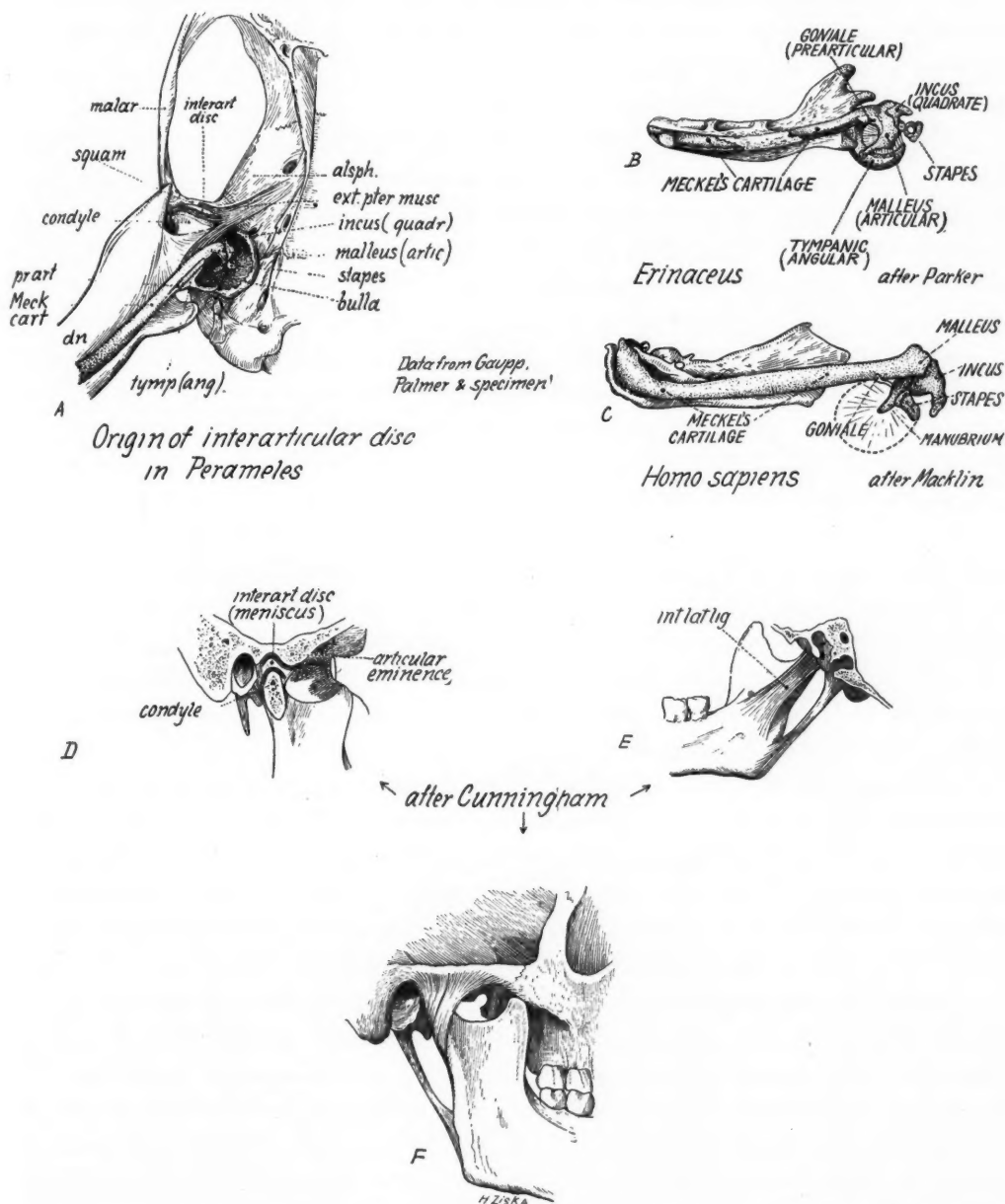


Fig. 6.—Origin of interarticular disc, "mandibulo-temporal" contact. Auditory ossicles in foetal stage formed from post-dentary jaw elements.

The human jaw is still in this general stage, and its evolution from the lower mammalian type has been traced through a rather closely graded series of transitional stages.

Meanwhile the history of the upper jaw¹ was briefly as follows:

I. The agnathous stage, in which the future upper jaw was represented by the continuous skeletal tissue of the first interbranchial septum.

II. The primitive gnathostome stage, in which the primary or inner upper jaw was represented by the paired palatoquadrate cartilages of paleozoic and modern sharks, serially homologous with one of the upper segments of the branchial arches.

III. The complex upper jaws of lower vertebrates above the shark grade, including an inner palato-ptyerygo-quadrate arcade more or less underlaid by dentigerous plates, and an outer upper jaw consisting of paired premaxilla, maxilla, continuous posteriorly with the jugal and quadratojugal elements. In this type of jaw the pterygo-quadrate bars still form the main supporting arches.

IV. The upper jaw of the higher mammal-like reptiles, in which the premaxilla and maxilla became dominant *pari passu* with the increase of the dentary of the lower jaw, developing palatal plates and forming with the palatines a secondary palate. Meanwhile the pterygoids and quadrates began the reduction which culminated in the mammals.

V. The upper jaw of mammals, in which the premaxilla and maxilla are entirely dominant, while the true pterygoids and quadrates become very small.

The human upper jaw is still in this general stage and the rise of its special characteristics may be clearly traced in the anthropoids and lower primates.

The series as a whole illustrates the profound reorganization and transformation of the skeleton in adaptation to successive environments and habits in the long series from primitive fish to man.

Among recent authors who have made the most significant contributions to the elucidation of this history we may mention Stensiö, for his detailed studies on the anatomy of the head of paleozoic ostracoderms, Gaupp, for his illuminating expansion of Reichert's theory of the origin of the ossicula auditus from visceral branchial arches, Broom and Watson, for their discoveries and descriptions of the jaws of the South African mammal-like reptiles.

Doubtless many internal environmental factors have contributed to the transformation of the jaw elements as summarized above. We do not have to subscribe to the Lamarckian hypothesis of direct transmission of acquired characters, but we cannot fail to realize that in any long view of a series of well-established structural changes in the skeleton there are definite structural responses to such factors as gravitation and to the stresses generated by muscular action. The muscles of mastication, according to good evidence, arose as extensions of the body musculature that were used in the spasmodic contraction and expansion of the branchial apparatus. But in connection with the change

¹Gregory, William K.: The Palaemorphology of the Human Head: Ten Structural Stages from Fish to Man. Part I. The Skull in Norma Lateralis. *Quart. Rev. Biol.*, 2: No. 2, pp. 267-279, June, 1927; Part II. The Skull in Norma Basalis. *Quart. Rev. Biol.* 4: No. 2, pp. 233-247, June, 1929.

from feeding on minute organisms to active predacious habits, one pair of gill arches and their muscles became enlarged and began to function as jaw muscles, while the enlarged shagreen denticles around the mouth began to function as teeth. From this point onward it seems very evident that the changes in the teeth, whether brought about by natural selection of small mutations or through some other mechanism, and the correlated changes in the jaw muscles, exercised a profound moulding influence upon both the form and relations of the bones of the lower and upper jaws and upon the supporting elements of the skull.

The adductor muscles of the primary or inner jaws seem to have been originally stretched across the primary joint between the palato-quadrate and the Meckel's cartilage, like the middle flexors of the branchial arches (Fig. 2 *D*). It is for this reason that the adductor or temporal muscles of all the lower vertebrates are still inserted on or near the proximal end of Meckel's cartilage. But in course of time, for reasons not yet entirely clear, the insertion began to spread on to the posterior or ascending process of the ensheathing dentary bone, which finally became greatly enlarged and took over by far the greater part of the insertion of the temporal muscle mass (Fig. 4 *A-G*). By a continuation of this process the ascending ramus of the dentary began to press upon part of its own muscle mass, thus giving rise (Fig. 6 *A*) to the bursa and interarticular disc and finally initiating the mammalian temporomandibular joint in the manner so well described by Gaupp.¹

No less important were the changes in the areas of origin of the temporal muscle mass. It is well known that in the earlier crossopterygian fishes, stegocephalians, and primitive reptiles, the derm-bone roof of the temporal region is unperforated. In the earliest predecessors of the theromorph series, on the other hand, there is already a lateral temporal opening which now separates the malar or jugal from the roof of the skull. Comparison with recent reptiles and mammals can leave no reasonable doubt that the margins of this primitive temporal opening, namely the rims formed by the jugal, squamosal and post-orbital bones, were being strengthened in response to the stresses generated by the jaw muscles, while the bone covering the central part of the muscle area had been thinned out, finally to the point of disappearance, as we can see in many other cases of bone fenestration throughout the vertebrates.

The creeping upward of the dorsal line of the temporal muscle toward the roof of the skull in the cynodont reptiles and their allies and the correlated dorsal upward and backward growth of the belly of the temporal muscle eventually conditioned the appearance of a sagittal crest in the cynodonts and primitive mammals, while the lambdoidal occipital crests arose in resistance to the stresses both of jaw and neck muscles. The subsequent reduction of these elements in the line of primates that lead toward or near to man was doubtless conditioned in part by the changing relations of the head to the backbone as well as by the enlargement of the brain and the final reduction in size of the jaw.

¹Gaupp, E.: Die Reichertsche Theorie. Arch. f. Anat. u. Entwicklungsgesch. Jan., 1912, pp. 1-416.

In conclusion, it would seem that the history of the upper and lower jaws of vertebrates, which in its main outlines has long been well understood by morphologists and paleontologists, would be of special interest to medical and dental colleges. Yet, so far as I can learn, the standard American and English textbooks on anatomy completely ignore even the cardinal fact that the temporo-mandibular joint is peculiar to the mammalian class.

SOME POINTS OF VIEW IN INTRAORAL STEREOSCOPY

BY ROMAN J. LEVY, D.D.S., NEW YORK, N. Y.

IDEAS AND INCARNATION

THE stereoscopic principle taken as a basis for intraoral stereoradiography requires a production of two images, known as the right and the left eye views, which being properly superimposed fuse in the brain, enacting an impression of depth.

This current conjecture, however, does not present a safe basis on which a method of proper application of stereoscopy for dental radiography could be built.

A more detailed and deeper insight of the fundamentals of our dual vision must be undertaken in order to grasp this bit of the bridle of science. This would safely establish a current and unperplexed way of constructing a system of apparatus in which the stereoscopic effect could be reproduced completely.

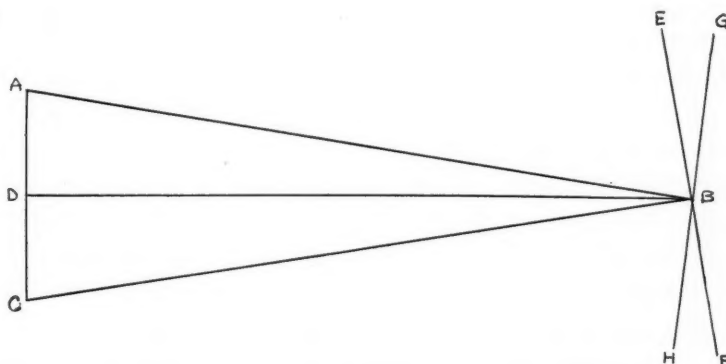


Fig. 1.

Let us assume that a simple point is to be contemplated stereoscopically. The viewing of this point is undertaken from a distance of 8 inches. (Fig. 1.) In this case an isosceles triangle will be formed. The base of it would equal the eye-pupil distance or $2\frac{9}{16}$ inches, while the altitude would be represented by the target distance, which is equal to 8 inches. Now the point viewed is placed at the apex of the triangle. Then the sides AB and BC will represent the rays of light emerging from the object or that point; these travel to the right and left eye pupils and cast the image on the surface of the retina, which in accordance with the law of physics will place itself in planes perpendicular to the light rays, EF and GH .

The superposition of the two images is shown on Fig. 1 and is represented by the two intersecting lines. The superposition of the images in the brain enacts a process whereby the right and left eye images cross each other under different angles, with respect to the length of the target distance. One may

observe the images lying on two different planes, which are never parallel to each other. For example, in order to explain the principle, one may view a certain object from a distance of 8 inches, then in this case the angles of the isosceles triangle lying at the base amount to approximately 80° each. Then closing the right eye, one could guide the left one in the direction of the left side of the triangle and visualize the object from that point of view. The image would distinctly differ from the one received by the right eye. This variance in question is twofold and diversified in its contents. The left eye turning to the right will see more of the right side and there will be a certain region which the right eye cannot see at all. The other difference belongs to the plane in which the image appears. The object being visualized in two perspectives instead of only one. The perspectives are perpendicular to the side lines of the triangle at the point of their intersection. The angle of their crossing will depend on the target distance from its terminal point from where the viewing is done. The target distance is identical with the altitude of the triangle.

The problem before me was to reproduce this phenomenon in a physical apparatus.

For this purpose I have constructed a film holder which can be revolved around its own axis, the amount of its turning being limited in accordance with target distance from which the exposures of the films are performed.

It is evident that the length of the shift must correspond with the altitude of the triangle. As the apparatus cannot be attached to the point emanating the rays directly, it is applied to the free edge or aperture of the Coolidge tube holder. The extent of the shift is smaller than the distance between eye pupils. It is estimated, however, that when the shift is made, the emanating point in the Coolidge tube passes exactly $2\frac{1}{16}$ inches, which is the intermediate eye-pupil distance of an average adult person.

The connection of the film holder to the Coolidge tube is obviously a disadvantage and a cause of some discomfort to the patient for a short period of time. However, considering the fundamentals of stereoradiography in the light of practical application to a mechanical apparatus, I was unable to see any other way of securing an accurate placing of the tube. It appeared to me absolutely necessary to connect the film holder directly to the Coolidge tube, in order to bring out the principles of stereoscopy in its essentials and purity.

The objections to the separation of the Coolidge tube from the film are based on the following facts:

The distance between the film and the outer surface of the cheek varies with every patient and region. The films must be set in absolutely the same position, and this alone is a tremendously difficult problem. The film being placed in the mouth can scarcely be seen and judged correctly with the respect to the shift. In every case we have to deal with the management of the film by the patient and we cannot rely on that alone.

Certain machines are supplied with a shift which performs the eye distance motion, the shift being accomplished around a pointer located in the

skin. The patient being independent of the machine does not experience any annoyances at all; nevertheless, it is useless as its functions are based upon an error. This error consists in the neglect of the distance separating the film from the pointer at the point where it touches the skin. The rays converge and intersect each other on the point on the skin, but as they are not terminated there, they diverge again until they reach the film. Here we find that the right ray went toward the left and vice versa. As the target distance is small, the deviation grows large by a distant position, the error being greatly increased.

RETENTION BY OCCLUSION

The position of the films in the mouth during the two exposures *must be* exactly the same. It is a difficult problem which has been subjected to a most serious and critical analysis. Lack of space and the peculiar shape of the oral cavity combined with the necessity of making an outward connection complicate the task. The situation gains new perplexity when we realize that a provision for rotary motion must be made at the same place.

After a long series of experiments, I have decided to use the dental occlusion as the method of retention, and a casket as a form to hold the films. In the way of retaining the film I have used the so-called bite method, but, contrary to the usual way of radiographing at right angles, I have used a *bisecting angle system* of angulation. At this time I find it necessary to make certain explanations. The bite method was made for the purpose of localization. It was a logical consequence of the collapse of the stereoscopic principles which have been practiced up to date. It was necessary to establish a way to ascertain the buccal or lingual position of some displacement in the mouth. These displacements could not be found by plain radioscopy way, but it was necessary, in some indirect way, to establish the third dimension principle. In respect to that it was entirely satisfactory to obtain only cross-sectional outlines of the teeth, as that would clarify their topographic relations.

My quest is different. I have found that the third dimension can be established with all its grandeur, by stereoscopic means. This combined with the system of angulation will produce a view where the long axis of the teeth can be shown with all the exactness feasible by the radioscopy means.

ANGULATION

The purpose of angulation for horizontally positioned films is exactly the same as for films placed vertically. The aim is to obtain a shadow equivalent to the image. In accordance with this purpose the methods of obtaining the angulated image are alike, and based on the use of the bisecting angle principle.

However, the process of applying this principle presents a diversity in theory as well as in practice. Though the calculation and composition of an angulation table for vertical films is hard and uncertain, the method of forming a table for horizontal angulation is extremely simple and constant, lying in the use of the occlusion which always creates a strictly horizontal plane.

Abstractly, an angle represents two geometrical elements (lines or planes) which intersect each other at a certain point, of these two elements the one (horizontal plane) is a constant factor, the other, representing the long axes of the teeth, being variable. Fortunately, the diversity of the second element in our angulation system is not considerable, only exceeding 25° , or $12\frac{1}{2}^\circ$ either way. This is essential in an appliance, for it creates a feasibility of building an apparatus without producing excessive elongation or foreshortening of the image.

In practical application of the horizontal film positioning there are two important conjectures worthy of mention. The height of the vault is of no significance, as it surely would be in vertical film position. The management of the film by the patient has no place in the method of occlusal retention.

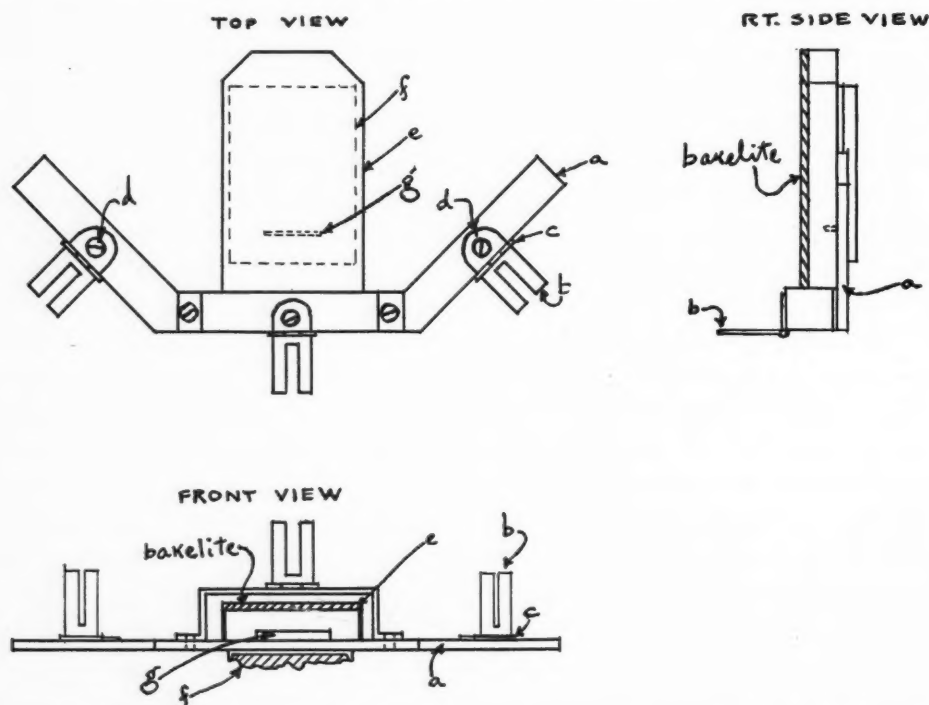


Fig. 2.—The mouthpiece: a, face bow; b, attachments; c, hinges; d, screws; e, film case (upper part of bakelite); f, bite tray with bite material; g, projection in case to hold the film in place.

The cited motions clearly show that the horizontal film situation in respect to the angulation system is superior and more certain than the one practiced in vertical film placement.

A seeming error in practice may happen when the expected length of shadow does not appear. Nevertheless this does not disprove the theory. It serves only as the indication that the long axis of the radiographed teeth does not correspond to the *normal* inclination but is inclined more or less from that position than normally assumed to be.

Another example of the same kind can be seen in a picture of a maxillary molar where the roots diverge in opposite planes; there, practically, the long axis does not exist at all. The buccal inclination would show a foreshortening, while the lingual or palatal would show an elongation.

In practical application of this angulation system, it may happen that not every machine on the market would have the means to accomplish a certain angle for the mandible. This can be remedied, however, by putting the Coolidge tube in a horizontal position and inclining the head of the patient.

THE APPARATUS

It consists of two principal parts: the shift which is attached to the free edge of the Coolidge tube holder and a mouthpiece which is, during the exposures, connected to the shift. The mouthpiece consists of a film holder which is permanently attached to the face bow. The latter has a link for attaching the Coolidge tube in three different positions, through the means of the shift.

THE FILM HOLDER

The film holder represents a case made of bakelite, with a wide opening at the front. The opening is in the direction of the orifice of the mouth for placing and removing the films. The case is long enough to reach to the rear of the mouth, and the film is placed at the back of the case. The height

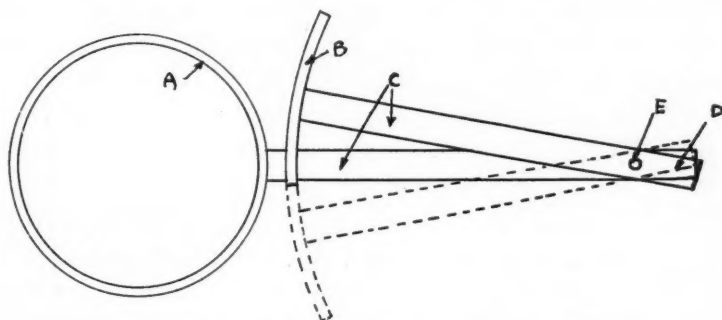


Fig. 3.—The shift: A, collar; B, band; C, bars; D, slip joint; E, pivot.

or thickness of it is sufficient to hold a pair of thin films with a sheet of lead between them. Some free space is left to provide an easy method of sliding the films in and out. An edge projects from the bottom of the case at the termination of the films. Its height equals the thickness of a single film, and it prevents the lower film from being dislodged when the upper film is removed. The bottom of the case is provided on its outer surface with a shallow tray to hold any kind of material in which indentations of the opposite teeth may be obtained as a means of immobility during retention.

THE BASE BOW

The film holder has only one way of being carried to and fro in the mouth; this is obvious, but the attachment and the placing of the Coolidge tube are not necessarily done at the same point on the film holder. To do that would mean to limit the technic to a proposition of radiographing the front teeth or front part of the mouth only. The rest of the mouth would appear as a side perspective.

I have eliminated this by constructing a face bow with three points of attachment for the shift and, consequently, of attachment to the Coolidge

tube. It would accommodate thus the three planes in which dental radiography generally occurs. The attachment of the shift to the face bow is made by means of a hinge by which provision is made for obtaining the vertical angulation, and by a screw permitting the rotary motion for the horizontal angulation. The position of these three attachments is carefully calculated so that the spot of anchoring it on the bow corresponds to the center of the film.

THE SHIFT

It represents two bars pivoted together and directed to the face bow. The free end of the first bar is provided with a collar, the second bar is inserted in this collar. This distance that the second bar may move in the collar corresponds exactly to the right and left eye positions. The second bar is also provided with a circular band of suitable diameter for the attachment to the free edge of the Coolidge tube holder. The pivoted end is provided with a slip joint connection for the attachment to the face bow.

METHOD OF USE OF THE APPARATUS

Load the film holder first, with a pair of thin films. Put one film into the film holder and push it in with a pair of pliers until it reaches the end of the case. A projection on the bottom of the case, as described above, will prevent it from sliding out. Then a strip of thin celluloid or strong paper is folded, and the other film with an underlying sheet of lead is placed into the fold and inserted into the case on top of the first film. The free ends of the doubled strip project from the case for the purpose of withdrawing the upper film after its exposure. The face bow must now be firmly attached or connected to the shift which in turn is firmly attached to the Coolidge tube. For taking the radiographs of incisors the central attachment is used, the others are used for the rest of the teeth. Before carrying the apparatus into the mouth, the hinge must be properly set with the screw and wing nut and a correct horizontal angulation obtained. The tray underneath the film holder contains some impression material. I prefer either soft wood or wax, or such materials as do not require application of heat. Only moderately tough substances capable of being compressed under pressure should be used. Besides it is important that we have the correct use of the vertical angulation in order to place it properly in the mouth, with respect to the direction of the horizontal plane.

Also the exact location of the film holder must be borne in mind. Do not forget that wherever the occluding surface of the teeth touches the film, it means the real start of the shadow image. With this in mind one may place the film holder in its proper place, without any undue haste, and then direct the patient to bite firmly. From the time that the mouth is closed, it should not be opened until the two exposures have been completed. The machine must be swung one way. When it reaches the terminal in the shift it becomes automatically locked in that position. The shift may be made either by moving the machine or the head of the patient or by a combined motion. The exposure is short. It is shorter than the ordinary exposure, as the whole

image will always be in the center of the rays. After the first exposure the top film is to be removed by pulling or drawing upon the projecting strip, and then the second exposure is made, in the same manner as the first, *but do not forget to shift the machine or the head of the patient before doing so.*

CONCLUSION

It is not necessary to be an expert in stereoradiography, neither is it necessary to know exactly the quality of the stereoscopic device in order to judge where it can be used most advantageously. All the topographic displacements in the mouth offer rich opportunity for a successful application of the stereoscopic principles. Thus orthodontic cases, impactions, cysts and other surgical cases and even simple exodontia offer sufficient material for its use. This much is clear in advance. But whoever uses the dental stereoradiographs and projects them in a suitable stereoscope, will have much more to say. It will be found that the remarkable effect of the stereoscopic principle is all comprehensive, and there is practically no limit in its use, whereby we may gain new information or interpretation.

If this is the case why then is the profession so deaf to this tremendous achievement? We hear very little about the research work in this direction. The colleges do not instruct students in stereoscopy, and the articles in the professional magazines are very scanty. All this is due to the fact that up to this time dental stereoscopy existed only in name and not in fact. The efforts of very esteemed members of our profession and of some manufacturers have failed in a most deplorable way. The best that was obtained represented that which was based on the merged pictures.

But right and left pictures, not properly obtained, will give no more than two identical pictures placed in a stereoscope. There will be a difference between plain pictures and two identical pictures put in a stereoscope, but this is due to the fact that the impression is intensified by the combined effect of the number of films and the action of the magnifying glass.

At the time when this thesis was presented, the profession could not be persuaded in its contention that these are real stereoscopic views. I hope that my efforts to awaken interest in dental stereoradiography will not fail, and that I shall find cooperation in my future investigations.

MEETING THE ANCHOR BAND PROBLEM*

BY CHARLES F. BOWLES, D.D.S., RICHMOND, VA.

FOUNDATIONS are the keynotes to the success or failure of all undertakings. Engineers, aware of this fact, place the greatest stress on ascertaining the permanence of the substructure, realizing that they cannot afford to gamble on the vital factor which will mark the permanency of their labors a success or failure.

In orthodontia, the foundation of the whole mechanism in the procedure of appliance construction, and the one to which we should give our most careful consideration, is the construction of anchor bands.

One of the most important of our diagnostic aids for determining the vitality of the tooth and surrounding tissue, and the probable resorption of the roots, is the x-ray. The resorption of the roots and the vitality of the tissues are conditions of grave importance at the beginning of any case, and without x-ray examination and overlooking any one of these conditions pertaining to the anchor bands, or appliance foundation, the possibility of subsequent failure is imminent.

However, satisfying ourselves as to the healthy condition of the anchor teeth is only one phase of the anchor band problem. We cannot hope for the efficiency or permanence of our working appliance without properly fitting anchor bands, the keynote of our foundation. In placing ill-fitting bands, we are not fooling ourselves. It takes just as long to make an ill-fitting anchor band as it takes to make one properly. There is no halfway ground. I have often made the four necessary bands on the first molars for some patient in less time than it will necessarily take for a single band for another patient who is not cooperative and whose teeth are not so well formed for successful band construction. However, conditions of this kind do not warrant hurrying through this step, but rather suggest devoting more time on account of the tendency toward displacement and breakage of the bands and appliance, with the irritation of the soft tissues as the faulty formation of the tooth and the difficulty of band adaptation increase.

There are several methods of meeting the molar band problem in practice today, and each has its advantages and disadvantages, but the one that proves most successful in the operator's hands is the one that should be studied and the technic perfected so that the minimum amount of time will be consumed with this step and the most perfect fitting band obtained.

The seamless molar band as perfected by Dr. Herbert A. Pullen consists of a complete assortment of bands of varying sizes for each first molar above and below and on either side. These bands are numbered, and this number is placed on a fixed angle of the band so as not to confuse the operator as to

*Paper presented before the American Board of Orthodontia.

which side of the mouth the band is intended for either the mandibular or the maxillary arch. These bands are well formed from an anatomic standpoint, and if due time is taken to select them of proper size so as to insure a snug fit, and if they are carried well down on the anchor teeth so as to miss the occlusion, you will practically eliminate the possibility of the loosening of the bands by the stress of mastication which is often followed by the displacement of the appliance and lodgment of food which acts as a menace to the health of the teeth and surrounding structures.

Another method of molar band construction with merit from the standpoint of efficiency and as a time saver at the chair, is the one recommended and used by Dr. James D. McCoy. This method consists of twenty-eight bronze metal dies made from as many carefully selected first molars of either side above and below. From these the bands may be made in the laboratory during leisure hours by the operator or technician and placed in four rows of seven compartments each so as to eliminate as many steps as possible in selecting the proper size and shape for the case in hand. This method practically eliminates all work at the chair excepting, possibly, a few minor adjustments in adaptation. However, to obtain any of the advantages claimed by the advocate of this method, it is apparent that the correct size and shaped band must be selected and due care exercised in placing it well down on the anchor teeth so that the occlusion of the opposing teeth will not come in contact with it.

Dr. Oren Oliver's standardized technic in the method of molar band construction has done more to simplify this direct method than has any other, in my estimation. There are arguments pro and con in regard to this method, but after seeing the originator of the technic make dozens of bands, some of which were for very nervous little patients with extremely short teeth and crowns badly formed, and in my own practice over a period of more than ten years, I am of the opinion that the objections to be considered are without foundation.

The principal objection is that the operator consumes too much time at the chair. In my own hands, and with others who have made a conscientious effort to perfect this method, I believe the consensus of opinion is that it is, in fact, a time saver, and any one who fails to find this true has not followed closely and in detail the technic as presented by Dr. Oliver.

It is necessary that the operator examine the tooth carefully so as to fix in his mind a mental picture of the size and shape of the molar tooth. This enables him to make the pattern follow the outline of the tooth as nearly perfect as possible before it is placed on the tooth, just prior to making the pinch with the S. S. White band forming pliers No. 326. The formed band is then placed in position with the $\frac{1}{16}$ in. right angle bend on the mesiobuccal angle of the tooth and the free end from the distobuccal angle. It should then be manipulated with the pliers until the occlusal portion of the material is carried down as far as desired, that is, below the marginal ridges, so as to be below the range of the cusps of the opposing teeth. Then, with the left hand holding the free end away from the cheek and at the same time stabilizing the

encircled pattern on the tooth, take the band adjuster in the right hand and firmly press the banding material against the lingual surface; then in against the mesial and distal angles on the lingual surface, where it will invariably stand away. Without releasing your hold with the left hand, take the band forming pliers in the right hand and place the mesial beak in the little right angle bend on the mesiobuccal angle and the distal beak on the buccal surface of the band on the distolingual angle of the tooth, and while holding the forward beak firmly to prevent slipping, bring the beaks tightly together in line with the buccal inclination of the tooth. Should each of these steps be carried out in detail, the operator will not experience any tendency to irritate the soft gingival tissue during the process of adaptation.

After the band is pinched in this manner, remove it and cut off sharply the distal end in the right angle bend and also in the groove on the short bend first formed on the mesial end, take a sharp pointed instrument, preferably a file, and make a definite mark from the occlusal to the gingival margins, and with the S. S. White pliers No. 142 straighten this out and bring the free distal end over on top and flush with, and on the same level with the mark $\frac{1}{16}$ in. from the end, holding it firmly and solder the joint together with 18-carat solder. After this, the contouring, festooning and seating of the band are carried out essentially the same as were described in the former methods.

These are the methods used most frequently in meeting the anchor band problem. There are, however, men who prefer measuring the circumference of the teeth by twisting either ligature wire or dental floss around them, removing this and making bands the exact length of the measurement. Still others carve the molar tooth to be banded on plaster casts and then construct the band by this indirect method on the models.

In some mouths there is a greater tendency than in others for the cement line between the bands and teeth to dissolve and leave spaces for the collection of food, which if allowed to remain will etch and weaken the enamel, thereby presenting an area with a predisposition toward decay. The bands should be removed and recemented about once every six to nine months so as to eliminate this fault which has caused the finger of suspicion to be pointed at the orthodontist by the general practitioner for many years.

We should realize that for our specialty to continue to occupy the place it rightly deserves in the field of medicine, we who are engaged in it should endeavor to render a greater service to our patients with the least amount of discomfort in the wearing of the appliances.

The majority of orthodontists use the first three methods described, and the method that is the most adaptable in the operator's hands is the method he should strive to perfect.

CASE REPORTS*

BY STEPHEN A. MOORE, D.D.S., LONDON, ONT., CANADA

IN PRESENTING the following case reports, I have tried to select cases of average difficulty which are treated in the practice of the average orthodontist. These cases have all reacted favorably to treatment, and the present condition is as shown or better. In Case 3, the maxillary left lateral is slightly rotated and there has been a slight drifting of the molar relation. I could not induce the patient, however, or in fact the parents, to have this corrected, because the child objected to the replacing of the bands.

Case 1 is possibly more extreme than the average condition but is a typical disto- or posterior occlusion case with a typical history.

Case 2 is of the same classification but somewhat different type. It is an average condition as presented for treatment.



Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Case 3 is somewhat out of the ordinary, being complicated by the retention of a deciduous canine. This fact probably exaggerates the appearance of the teeth.

Case 4 is just an average case with the canines in supraclusion. The fact that one of the premolars was extracted in the treatment of the condition is interesting.

Case 5 is a very interesting case of mesio- or anterior occlusion. This case should have been treated at a much earlier age, but a fair result has been obtained.

CASE 1.—The patient was a young girl eight years, eight months of age. She was suffering from rickets and had had previously, measles, chickenpox and mumps, the first two diseases twice. She suffered from recurrent colds but

*Presented before the American Board of Orthodontia.

recently had her tonsils and adenoids removed, and there appeared to be some improvement. At the time of her birth and previous to it, her mother had been very ill. The child was a bottle-fed baby, the pacifier had not been used, but she had a habit of biting her lip and was a mouth breather. Both parents and her brother have irregular teeth, but the father and brother have a neutroclusion condition. All her life the child has been under the care of a physician, and a great deal of the time has required the services of a nurse.

She presented herself for consultation on September 21, 1922, Figs. 1, 5 and 9. The condition of her teeth on October 7, 1922, is shown in Figs. 13 and 15.



Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.



Fig. 10.



Fig. 11.



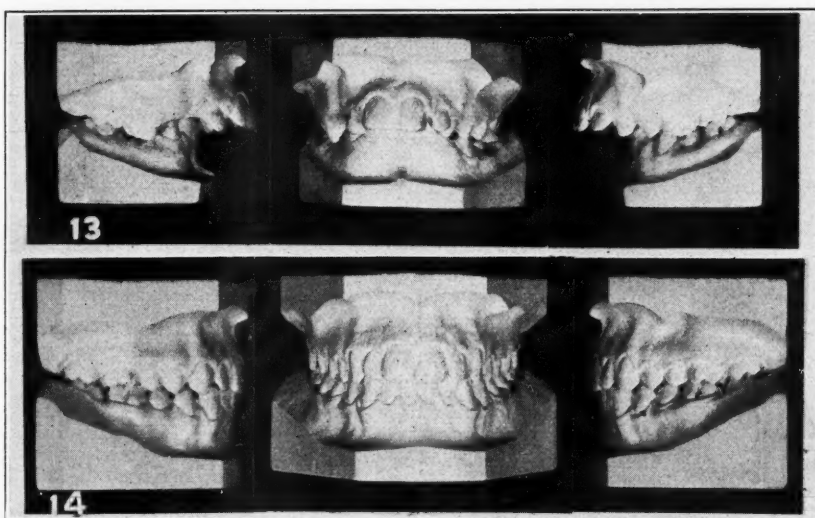
Fig. 12.

On October 7, 1922, appliances were placed in her mouth. The maxillary first permanent molars were banded, and a soldered lingual alignment wire was attached to stabilize the molars. Buccal tubes were added and a high labial alignment wire with intermaxillary hooks and finger springs on the four incisors. In the mandibular arch the first permanent molars were banded. A soldered lingual alignment wire was attached resting against the mandibular incisors. Wire stretching pliers were used on this alignment wire. Hooks were soldered on the buccal surfaces of the molar bands, and intermaxillary elastics were used day and night with certain rest periods as conditions indicated.

On February 13, 1924, sixteen months later, the condition was as shown in Figs. 2, 6 and 10. At this time the mandibular appliance was changed. A

labial alignment wire was placed in the child's mouth with finger springs resting near the incisal edge of the incisors, and by means of ligatures the roots of the teeth were moved forward. Intermaxillary elastics were still being used.

On November 20, 1924, the mandibular appliance was again changed for a removable lingual alignment wire with finger springs.



Figs. 13 and 14.

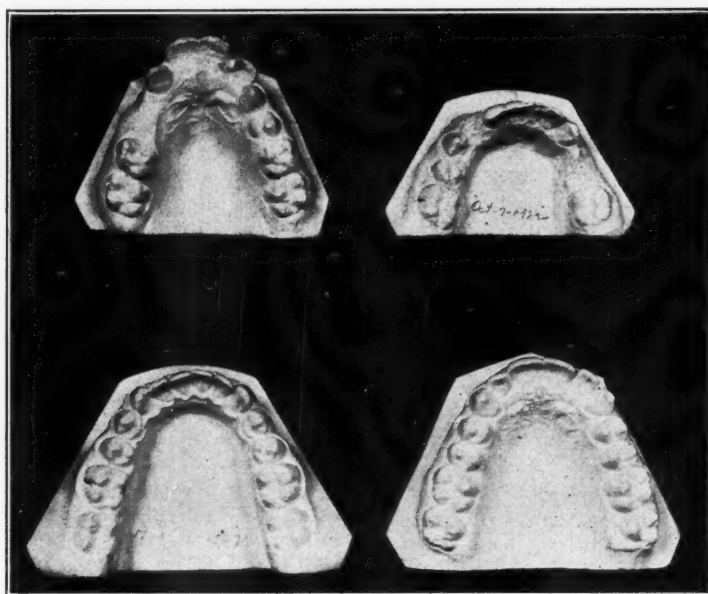


Fig. 15.

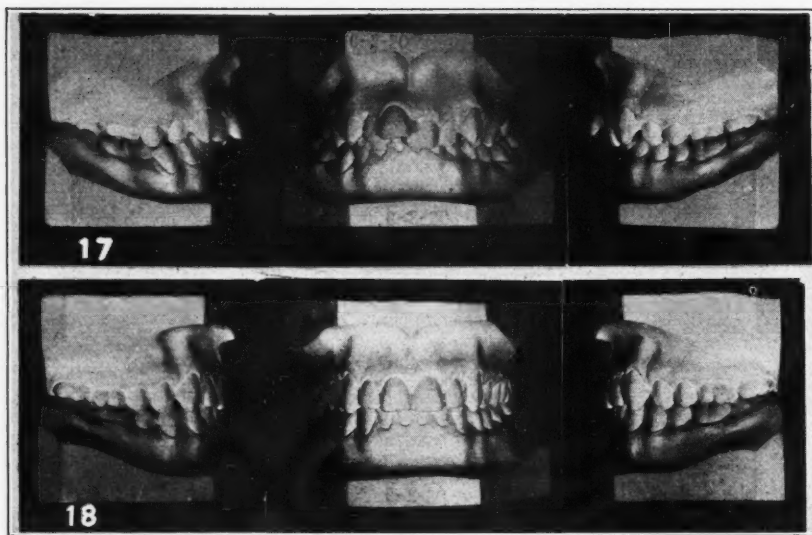
On August 12, 1925, both appliances were removed and a Hawley vulcanite bite plane was inserted. This was lost in November of the same year and another made. At this time all the child was wearing was the bite plane. This was worn less and less, until in March, 1926, its use was discontinued and the child had no appliance in her mouth. In May of the same year, there appeared to be a slight relapse of the mandibular incisors, particularly the left

lateral incisor. A removable lingual alignment wire was placed in position with a recurved spring resting on this tooth. This was worn by the patient until the spring of 1927. In April she came to my office with the appliance broken, stating that it had been off for some time. The teeth seemed to be holding their relations, so I left the appliance off and she has worn no appliance since.

On July 28, 1927, I dismissed the patient and her condition was as shown in Figs. 3, 7, and 11, with models of her teeth as shown in Figs. 14 and 15.



Fig. 16.



Figs. 17 and 18.

During the treatment of this case, there were frequent rest periods of one month up to four months, and for the last three years the patient has been using Dr. Roger's muscle exerciser. The diet was watched very closely throughout the treatment of the case.

On January 16, 1929, the patient happened to be in my office with another patient undergoing treatment and allowed me to take the pictures shown in Figs. 4, 8, and 12. I had not seen her since July 28, 1927, when I had dismissed her, and the condition of her teeth was better in 1929 than in July, 1927.

CASE 2.—On September 10, 1927, this patient, a young girl fourteen years, two months of age, presented herself for consultation. She was 62" tall and weighed 84 lb. The condition present is shown in Fig. 16. The models of her teeth are shown in Figs. 17 and 19. Her oral and general health were good. There did not appear to be any inherited tendency to this condition. Adenoids and tonsils were present but appeared to be normal. She had never used the pacifier and was a breast-fed baby. She had had mumps,



Fig. 19.

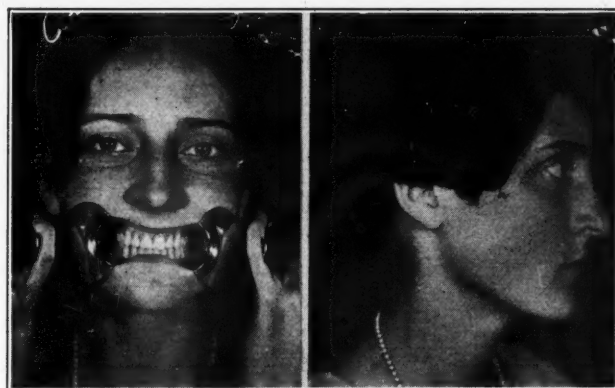


Fig. 20.

measles and chickenpox. She lived on the farm and her diet seemed to be all that was required.

On October 8, 1927, appliances were placed on her teeth. The maxillary first permanent molars were banded and buccal tubes added, and a labial alignment wire was adapted to the irregularities of the teeth. Intermaxillary hooks were soldered to the alignment wire but intermaxillary elastics were not used at the start of the treatment. Ligatures were used to move the incisors forward.

On January 14, 1928, the mandibular appliance was placed in position, consisting of buccal tubes on the banded first permanent molars with a labial alignment wire. This could not be placed in position previously on account of the bite. The patient started using intermaxillary elastics at this time.

On April 3, 1929, the mandibular appliance was removed and a soldered lingual alignment wire attached to the banded molars and inserted for retention. On April 4, 1929, the maxillary appliance was removed and a Hawley vulcanite bite plane inserted. This was worn less and less and was finally discarded early in the spring of 1930 when the mandibular lingual alignment wire was removed.

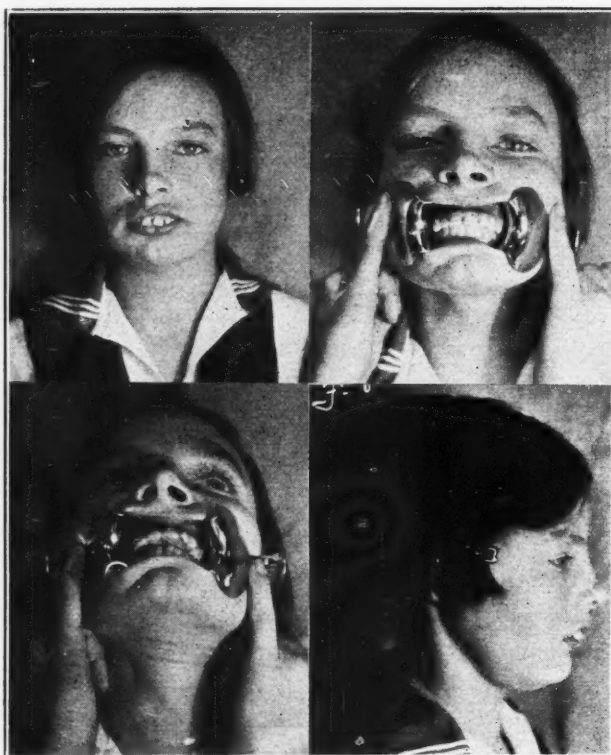


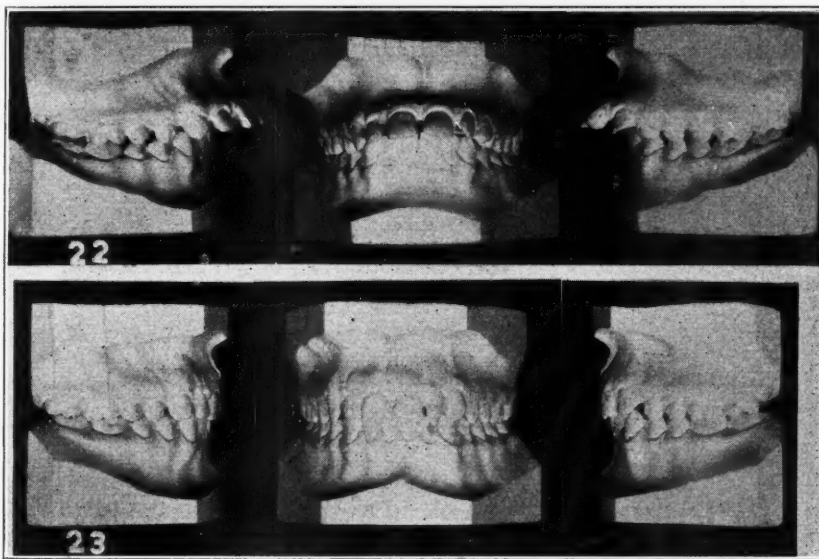
Fig. 21.

On August 21, 1930, the patient was dismissed when her condition was as shown in Figs. 18, 19, and 20. I saw this patient a short time ago and her condition is very satisfactory.

CASE 3.—This patient, a young girl, presented herself for consultation on October 29, 1925. At that time she was twelve years, six months of age. Her appearance was as shown in Fig. 21. Her height was 57" and weight 72 lb. Her general and oral health were good, masticating efficiency was poor and no caries was present. Her father had had protruding teeth but was wearing artificial dentures. Her mother's teeth were normal, and also the teeth of her sister. The adenoids and tonsils were present but appeared normal. She had been breast-fed but had used the pacifier, was inclined to mouth breathe and bite her lip. Some time previously she had had mumps and measles. At the

present time she was living on the farm, and her general health and diet seemed very good.

On November 14, 1925, appliances were placed on the teeth, the appearance of which may be seen in Figs. 22 and 24. The maxillary left deciduous canine was extracted. Bands were placed on the maxillary first permanent molars and buccal tubes added for a labial alignment wire. Bands were also placed on maxillary central incisors with lugs on the labial surfaces into which the arch wire rested. Intermaxillary hooks were soldered to the alignment wire. In the mandible, the first permanent molars were banded and a soldered lingual alignment wire was adapted. Hooks were soldered on the buccal surfaces of the molar bands for intermaxillary elastics. The nuts on the maxillary alignment wire were kept away from the buccal tubes so that the pressure was ex-



Figs. 22 and 23.

erted on the incisors when the intermaxillary elastics were being worn. In this manner the maxillary incisors were retracted and the mandible was brought forward.

On December 17, 1927, all the appliances were removed, and a Hawley vulcanite bite plane was inserted in the patient's mouth. This was worn intermittently and gradually discarded, and the patient was dismissed on August 8, 1929. The models of the teeth are shown in Figs. 23 and 24. The appearance of the child is shown in Fig. 25.

The result is not just what it might be but I offer no apology for it. I had great difficulty in securing cooperation of the patient and parents. There had been considerable improvement in the appearance of the child, and they had considered the case completed months before I had dismissed her.

CASE 4.—On December 7, 1923, this young boy presented himself for examination and consultation. He was eleven years, nine months of age, weighed 73 lb., oral health was good and his general health fairly good. His masticating efficiency was just fair, and he had a condition of neutroclusion with the drifting forward of the maxillary first permanent molars, probably due to the

premature loss of the second deciduous molars. The teeth of the parents were normal, and there appeared to be no inherited tendency. Adenoids and tonsils were present but seemed normal. The child had had measles and chickenpox. The appearance of the patient is shown in Fig. 26-A and the condition of the teeth in Figs. 27 and 29.

On December 28, 1923, appliances were placed on the teeth. The maxillary first permanent molars were banded and buccal tubes soldered on the

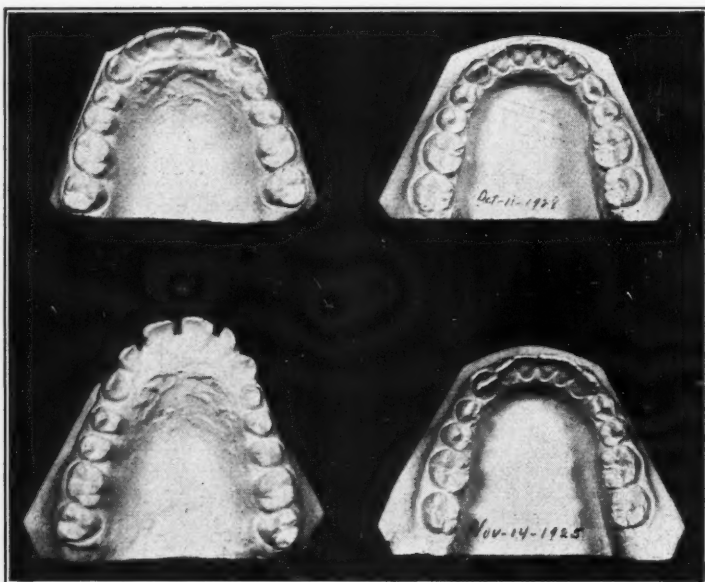


Fig. 24.

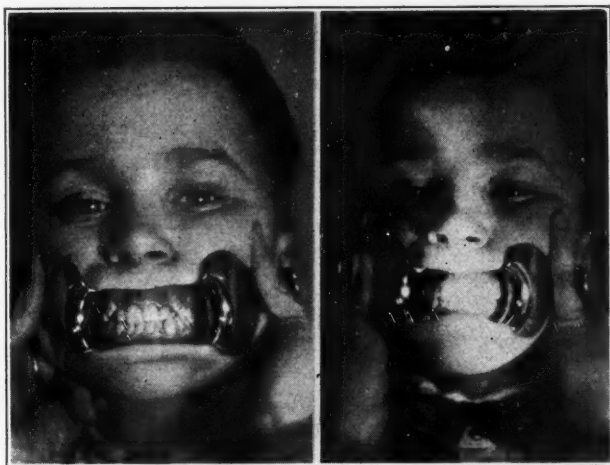


Fig. 25.

bands for a labial alignment wire. The two maxillary lateral incisors were banded and hooks soldered on the lingual surfaces to keep the ligatures from slipping. Springs were soldered on the alignment wire so that they rested on the canines to bring them down from supraclulsion. On the mandibular arch, the first permanent molars were banded and a removable lingual appliance with a Mershon lock was adapted. A recurved finger spring rested on the lingual surface of the mandibular incisors. Intermaxillary hooks were soldered on the

maxillary alignment wire and also on the buccal surfaces of the mandibular molar bands.

At this time I had not definitely decided to have the maxillary second premolar on the right side extracted but did so a few months later. I then proceeded to move the maxillary first molar on the right side forward and the corresponding molar on the opposite side somewhat backward. Space was



A.

B.

Fig. 26.



Figs. 27 and 28.

developed in the anterior portion of the maxilla for the lateral incisors and canines, and on July 24, 1925, the appliances were removed from both jaws and a soldered lingual alignment wire was attached to the bands on the mandibular first permanent molars for retention purposes. No appliance was placed on the maxillary teeth.

The soldered lingual alignment wire on the mandibular teeth was removed in the Christmas holidays, 1925; and on March 23, 1926, the patient was dismissed, the condition being as shown in Figs. 26-B, 28, and 29. I have seen

this patient since and the teeth have improved in appearance, probably as a result of normal function.

CASE 5.—This patient presented himself to me for the first time in 1920. I advised treatment but the family physician discouraged it, stating that the condition would correct itself. This advice the parents followed to their regret.

On May 7, 1926, he again presented himself, at the age of sixteen years. His appearance was as shown in Fig. 30, and the condition of his teeth as shown in Figs. 31 and 32. He was 71" tall and weighed 140 lb. His general health was good but his oral health was very poor. His teeth were in a condition of mesioclusion with a prominently developed mandible and a micro-maxillary development. The parents did not have this condition but both had well-developed mandibles. Both his adenoids and tonsils had been removed some time before.



Fig. 29.

On May 28, 1926, the maxillary appliance was placed in position. The incisors, premolars and first permanent molars were all banded and half-round tubes placed on the labial and buccal surfaces. A labial alignment wire 0.030 round was adapted to the teeth, and half-round wires were soldered to it to fit the tubes on the bands. An inverted U-loop was made in the alignment wire on each side in the region of the canine so that pressure could be exerted on the incisor teeth by expanding this loop. Intermaxillary hooks were soldered in the region of the first molars.

On June 26, 1926, the mandibular appliance was placed in position. The first permanent molars were banded as well as the four incisors and half-round tubes soldered on the buccal and labial surfaces. A 0.030 round labial alignment wire was adapted to the teeth, and half-round wires were soldered to it to fit the tubes on the bands. Intermaxillary hooks were soldered in the region of the canines and lock wires soldered to both alignment wires to hold them in

place. Intermaxillary elastics were worn. The four maxillary incisors were moved forward first so that they were in fairly normal position, there being space enough for a premolar between the lateral incisors and canines.

The canines were then banded and half-round tubes soldered to the labial or buccal surfaces. U-springs with half-round wires were then used to move

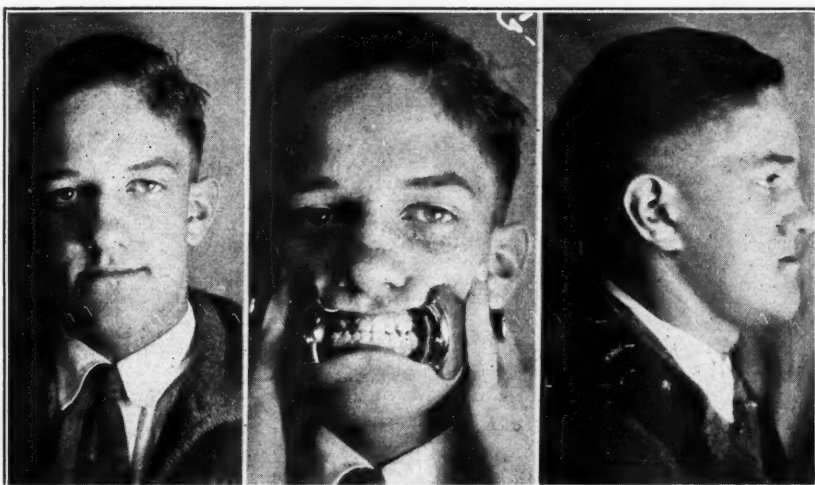


Fig. 30.

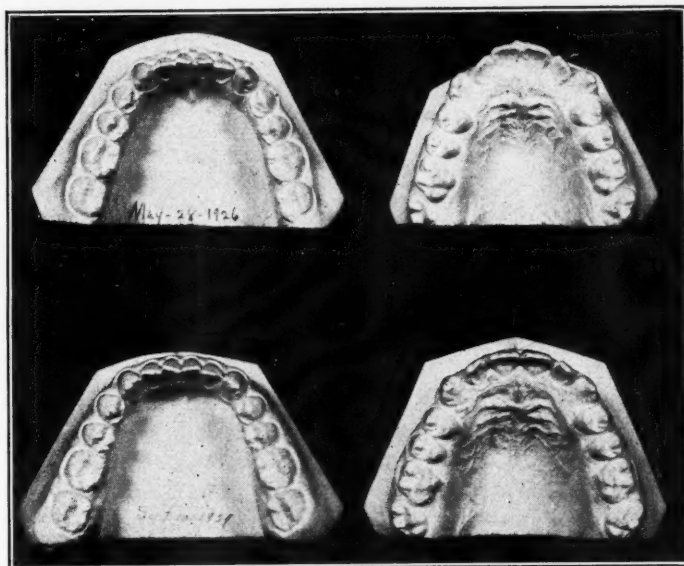
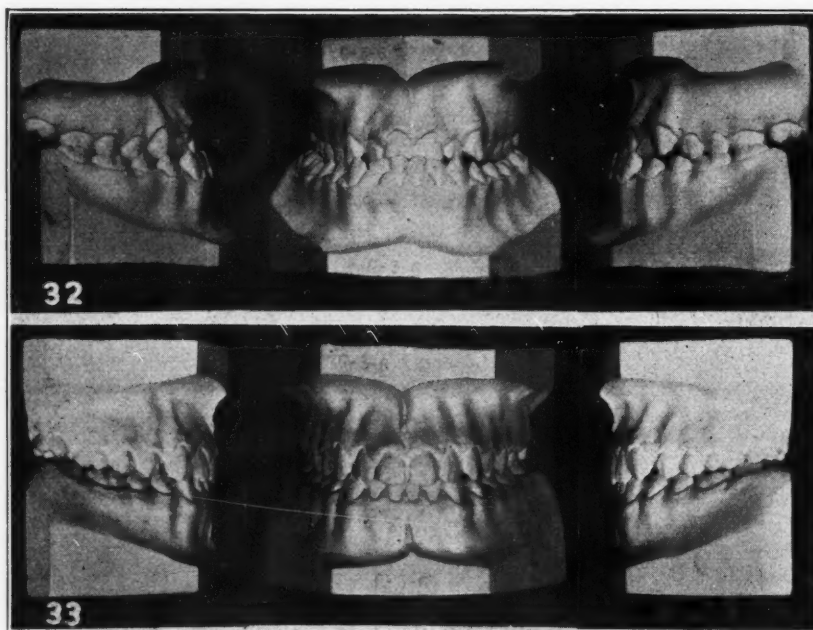


Fig. 31.

the canines forward into position next to the lateral incisors. Half-round wires were then fitted into the tubes on the canines and soldered to the alignment wire to hold them in position.

The first premolars were then moved forward in the same manner followed by the second premolars. In moving the first permanent molars, the second permanent molars were banded and half-round tubes soldered on the buccal surfaces and the alignment wire was extended to these teeth with half-

round wires fitted in the tubes. The first permanent molars were then moved forward by means of the U-springs. It might be noted that during all this movement, intermaxillary elastics were being worn to stop any posterior movement of the maxillary teeth. When the first permanent molars were in position, the attachments were changed and the U-springs attached to the second permanent molars and these teeth moved forward.



Figs. 32 and 33.

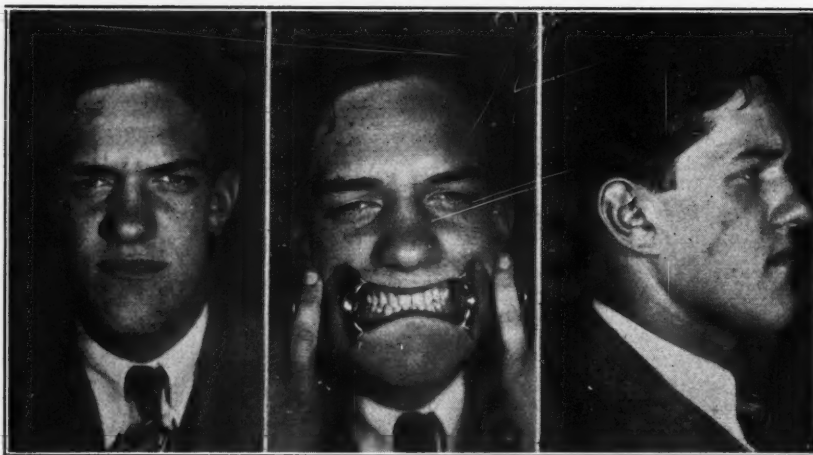


Fig. 34.

In the fall of 1928 the teeth were all in position and on January 22, 1929, all bands were removed except those on the maxillary central incisors and first permanent molars. The bands were also left on the mandibular molars but removed from the incisors. The original labial alignment wires were worn on both the mandible and the maxilla with intermaxillary elastics, which were gradually discontinued.

On September 9, 1929, all the appliances were removed and a soldered lingual alignment wire, closely adapted to the teeth and attached to the molar bands, was placed on the maxilla. This became damaged accidentally and was removed the next day and not replaced, the condition being as shown in Figs. 31 and 33. The appearance of the patient may be seen in Fig. 34. The facial casts shown in Fig. 35 are rather interesting.

This patient was not definitely dismissed until January 31, 1930.



Fig. 35.

The last time I examined his teeth was on July 8, 1930, and the relations were as shown. I received very poor cooperation from the patient, and in fact discontinued the treatment twice but resumed it after promises of better cooperation. He had absolutely no regard for an appointment and missed more than he kept. His intentions, however, were golden and his apologies profuse.

My treatment might be criticized from the standpoint that I did not move the mandibular teeth distally, or if I did it was very slight. In this particular case I do not think it would be possible without extraction, and there is no doubt that the maxilla required development. If I were doing this case again my treatment would be along similar lines.

REPORT OF THE SECOND INTERNATIONAL ORTHODONTIC CONGRESS*†

BY L. M. WAUGH, D.D.S., F.A.C.D., NEW YORK, N. Y.

EN ROUTE from abroad, our president requested that I give a report of the Congress at our autumn meeting, and in the optimism which had risen during the vacation, I consented, even though fully aware of the many demands on my time after my return. Today, I am glad that I consented because it will not only give me an opportunity of telling all of you, but also of telling the man who was primarily responsible for the First Congress and who also worked harder than any American to promote the Second Congress, more of the real happenings than he has probably learned heretofore. I presume most of you know what a *faux pas* he made in London. He was tired on leaving home, took cold on shipboard, played golf in the rain after reaching London, had a chill, went to bed ten days before the Congress opened, and stayed there until one month after it had closed. But enough said, Doctor Fisher is present with us today, much to every one's gratification, and is already beginning to help lay plans for the Third Orthodontic Congress.

As I began the task of preparing a report, I found it difficult to know just what to present and how best to do it, because I realized that no two persons would be impressed with the importance of the same things and it would be quite unwise to attempt extended detail about anything. I feel sure you will want to hear not only of the scientific part of the Congress but also of the professional standing of our specialty in the various foreign countries.

The Savoy, one of London's leading hotels, was wisely selected as headquarters. It is situated in the ancient city of Westminster on the bank of the Thames, almost in the shadow of London Tower. It is the popular stopping place for American tourists and is conducted on the same high plane as are the very best hotels in New York.

The meeting rooms were spacious and quiet, and the lantern equipment for both still and motion picture projection was of the newest and best.

The halls for the demonstrations and museum exhibits were well appointed and were provided with excellent show cases, conveniently arranged and fully posted with placards which were all in place prior to the opening of the meeting. Too much credit cannot be given our British colleagues for careful attention to the most minute details. I feel that they are most deserving of the sincere reciprocation of the high compliment they paid us for the arrangements of the First Congress.

Orthodontists from twenty-three nations were in attendance, and despite its being a most busy season for the Britishers because of the closing of schools,

*Held in London, England, July 20-24, 1931.

†Presented before the New York Society of Orthodontists, November 11, 1931.

the latter part of July, the local confreres were present in goodly numbers. And I must say here that it has never been my good fortune to meet a more cordial, finer group of professional gentlemen than those who greeted us in London.

There were twenty-three component societies distributed as follows: Great Britain: five societies, one each in Australia, British Isles, Canada, Ireland and New Zealand. There are two so-called European societies on the Continent which are international in their membership. Germany, two societies; France, one; Japan, one; Holland, one; and the United States of America, eleven. It is gratifying to note here that the New York Society of Orthodontists provided the largest supporting membership of any society.

The opening session was convened punctually at the announced time. The assembly room was spacious, rich and dignified in its appointments. A good-sized and representative audience was present. The President-General and members of the Council were seated on the rostrum. The Honorary Presidents and other delegates from abroad were seated by place-card in the front semicircle of chairs adjacent to the platform. On signal, the audience rose as the procession of the Worshipful the Mayor of the ancient city of Westminster entered and marched down the aisle to his place at the right of the President-General. He was clad in the official robes of his office and was preceded by the bearer of the official mace, which is the staff borne before a dignitary as an ensign of his authority. He was followed by His Majesty's Minister of Health, who later delivered the message of welcome. The Charter of Westminster dates back to the reign of King Henry VIII. The opening of the Congress by His Worship the Mayor was simple and sincere and created a delightful sense of at-homeness. The address sparkled with subtle humor and was especially impressive because of the understanding shown of the scope of orthodontic service. This was, undoubtedly, due in part to the fact that two of the cousins of His Worship were dentists, and also to a perusal of a copy of the Proceedings of the First Congress which had been presented to him. The message of welcome was given by His Majesty's Minister of Health, and was notable for graceful cordiality and ethical force. After a hearty rising vote of thanks to the Mayor of Westminster and the Minister of Health and after their processional leave-taking, the President-General called in turn each Honorary President and other delegates from abroad to the platform, welcomed him by official handclasp and announced him to the assemblage. Thus was the Second Congress opened in an atmosphere of pleasing and impressive dignity and of utmost good-fellowship. The unusual attention given to orthodontia by the highest officers of the historic city was a most gratifying token of the esteem in which our colleagues are held for their service to the people of the municipality. Never has my pulse quickened with greater pride than in this gracious official recognition of the achievements of orthodontia. My heartiest congratulations to our colleagues of London. My memory wandered back to the recognition given to the opening of the First Congress by His Excellency, the Governor of the state of New York, and to the address of welcome delivered by Doctor Augustus S. Downing, Assistant Commissioner of Education, in charge of professional education of the state of New York. The morning session was completed by

the reading of the President-General's address, a masterly and philosophic message which is urgently commended to all for study as soon as it is published.

There were twenty-nine papers to be presented and three to be read by title. The officers expressed themselves to me as regretting that so many had been accepted for reading, as it left little time for discussions. However, they will make good reading in the published proceedings; the papers were tabulated under the following headings: research 5; education 3; etiology 5; diagnosis 5; treatment 11; technic 3. Total: 32 papers contributed by the following countries: Austria 1; Belgium 1; Canada 1; Chili 1; Czechoslovakia 1; England 4; Germany 6; Holland 2; Italy 1; Switzerland 2; Syria 1; Sweden 2; United States 9, four of which were contributed by members of this Society. Of the eleven papers on treatment, there were three dealing with extractions as a necessary part in successful treatment. These were all well presented and brought out considerable discussion. My reaction is that unless the orthodontist is most careful to emphasize the fact that extraction is comparatively seldom resorted to, there will be a bad misunderstanding on the part of younger specialists and especially on the part of the general practitioner who is so easily led into thinking that alignment of anterior teeth is sufficient, forgetting that occlusion of the posterior teeth is the essential consideration in proper treatment. There were four papers on methods of facial measurements as an aid in diagnosis, a practice much more used abroad, especially on the Continent.

There were thirty-three demonstrations divided as follows: technic and treatment 21; scientific studies on growth changes 3; facial measurements 5; miscellaneous 4. Of these, the United States contributed 17, of which members of the New York Society of Orthodontists gave 8. The demonstrations furnished an important part of the meeting and were well prepared and given over an extended period to large groups. The refinement of technic from America stood out conspicuously. Measurement methods in diagnosis and planning of treatment characterized the work of Europeans of several countries.

The demonstrations of appliance-making of stainless steel with electric spot welding and soldering were most disappointing to me, as I had been told by several prosthodontists who had been abroad previously that a revolution in orthodontic appliance-making was upon us. I, however, saw nothing that I could consider as worthy of practical application, although there was probably more attention being given these two demonstrations than any others, and many members from the Continental countries seemed favorably impressed. I do not mean to imply that there may not be future developments of value.

There were eight exhibits that were shown more or less continuously in the afternoons. There were always audiences of satisfactory size. All were of sixteen M.M. size, except one which was shown once to the general body in the large assembly room. This method of exhibiting and teaching is valuable and is gaining in importance. I urge members to consider it when preparing material. I look for the time, not far distant, when a circulating library of reels on orthodontic procedures will be available. Four of these came from the United States, two being from the New York Society of Orthodontists.

The Museum is deserving of high commendation. A hall of ample size was provided, and the arrangement of excellent show cases added greatly to safety

of material and to convenience of study. The generous use of placards served to give ready information. The quality of material was excellent and much of it worthy of a place in a permanent exhibit. There were forty-two names on the list, some of whom showed several things. Twenty-two exhibitors came from the United States of which thirteen are members of the New York Society of Orthodontists. Seventeen exhibits were from Great Britain. It was gratifying to see three excellent sets of preparations of development of structures of importance to the orthodontist, brought there and set up by the professors of two English and one Irish universities. These professors were present at the meetings and contributed to the discussions. A full week could have been profitably devoted to the study of the Museum.

The entertainment was of the highest order and most generous. There was a quiet graciousness about it all that was delightful and disarmed all feeling of obligation. There was a reception on the first evening in the Savoy Hotel, followed by a popular lecture by Professor Grafton Elliott Smith, F.R.S., entitled "Evolutionary Tendencies Affecting Both Teeth and Jaws." This was followed by dancing in which practically all indulged until well after midnight. On Tuesday, the ladies were entertained by sight-seeing and trips on the river Thames. The men from abroad were entertained at luncheon at the Hotel Victoria as the guests of the European Orthodontological Society. On Tuesday evening, the members and their friends were the guests of the President and the Council of the Royal College of Surgeons of England at the College in Lincoln's Inn Fields. Sir Arthur Keith, F.R.S., gave a short discussion on "Fashion and Deformity" and Sir Frank Collyer, K.B.E., Curator of the Orthodontological Section of the Museum, showed specimens of special interest. On Wednesday (July 22) a golf tournament was held at Sunningdale, Berks. There were two trophies, the Congress Cup and a second prize. A goodly number participated. The Museum and the demonstrations were not interrupted as the program was too full to permit. The ladies were taken on a visit to London Tower and the House of Commons. A banquet was given on Thursday evening at the Savoy Hotel, which was attended by five hundred, and was a most auspicious and delightful event. Time will prohibit even a brief description, suffice it to say that to me it provided an altogether new standard of delightful efficiency in arrangement. The farewell luncheon on Friday (July 24) at the Hotel Victoria was attended by about one hundred members from many countries at which generous felicitations were exchanged and a pledge was given to support the Third International Orthodontic Congress.

The final business session was well attended. The Treasurer-General, E. D. Barrows, reported that the expenses of the meeting were assured with a surplus to serve as a nucleus for the Third Congress. The exact figures could not be given until after all the bills had been received. He reported slightly over four hundred registrants, this being a small gain over the First Congress. There was discussion regarding the place for the holding of the next Congress. Invitations were extended from several countries, among them Austria, France, Germany and Japan. The discussion brought out that while it was the hope to visit a number of the countries in turn, it seemed best to have the next Congress in America as one more big meeting would reasonably assure the

future of the Congress, at which time the majority might vote to go to other than an English-speaking country. Canada extended an invitation as also did the United States; the exact place of meeting was left to the decision of the officers.

BRIEF SUMMARY

Knowledge in the fundamental sciences has been more valued and sought abroad.

Teachers in the fundamental sciences abroad have been interested for a longer time in orthodontic problems and are, therefore, better informed on special orthodontic needs and applications in their particular branches.

Orthodontic education seems to be practically a minus quantity abroad. I regret to have to make this comment, but it is based on my inability to learn of any school where it was being seriously taught, and to the lack of discussion given by our colleagues residing abroad to the papers on education.

Scientific knowledge does not seem to be well applied to practice by the orthodontist abroad. He has an urge for research but has not produced much of practical value and does not seem to apply what he has learned. This is probably due largely to lack of exclusive specialization; therefore, there is less concentration in practice.

Biometrics, gnathostatics, and cephalometric methods are more used abroad, especially on the Continent.

The advantages of exclusive specialization were more firmly impressed upon me than ever, as nowhere has orthodontic service reached the development that it has in the United States, as attested by the quality of treatment given the patient.

We must, however, appreciate the benefit of knowledge in the fundamental sciences and work zealously for improvement, since our real solution of the problem that daily confronts us must be largely solved by this means. To this end we must as a body embrace every opportunity to interest researchers and those who support them in the solution of the problems confronting orthodontia.

We should work more closely with our colleagues from abroad, as they have much to give us, and I hope that we, of America, shall have some information of importance to give in return.

In closing, may I express the hope that my comments may offer offense to no one. They are, after all, the opinion of only one observer, and as I said in the beginning "no two persons would be impressed with the importance of the same things."

DEPARTMENT OF ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

Under Editorial Supervision of

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DIAGNOSIS AND TREATMENT OF CHRONIC OSTEOMYELITIS OF THE MAXILLA INVOLVING THE MAXILLARY SINUS

BY STERLING V. MEAD, D.D.S., WASHINGTON, D. C.

(Concluded from November issue.)

PROGNOSIS

The immediate danger from the primary type of osteomyelitis is not great. There is a low grade infection which gradually undermines the general system and resistance of local tissues and is often the cause of a flare-up of an acute osteomyelitis.

The greatest danger is the difficulty in recognizing the existence of the disease until it has caused widespread bone injury or has seriously endangered the patient's general resistance.

TREATMENT

The treatment of primary chronic osteomyelitis is entirely different from that of chronic osteomyelitis following acute osteomyelitis. In the primary type it is necessary completely to eradicate surgically the diseased area.

Of great importance in these cases of chronic osteomyelitis is the patient's general condition. A complete physical examination should be insisted upon, and any irregularity should be corrected. The examination should give special attention to the blood picture, blood chemistry, uranalysis, etc. In many of these cases where they are operated radically the patient will get remarkable results and be free from trouble for a number of months, in many cases for a year or more and then again return with the same symptoms.

It has been my experience in these cases that the return of the disturbing symptoms is due to the lack of attention to building up the patient's bone forming defense. In these chronic osteomyelitis cases, it is often found that the patient's metabolism of calcium and phosphorus as shown by the uranaly-

sis is low and that they do not have the necessary supply of these essential elements to build back the lost tissue. The surgical operation may become a failure even though it removes the pathologic tissue if it does not provide a method of restoring the diseased area to normal.

It should be in the plan of the operator to remove all areas of infection and surgically to remove diseased areas and not be content with the surgical eradication of the disease but to supplement surgery with a program of additions to diet, and medication, tending to building up the patient's general condition, improve the blood picture, and enable him to build back the lost bony structure. It has been shown particularly in the work of Howe, Sherman Davis, and others, and in the particular work in the scope of this paper that patients having these particular types of areas of disease and whose uranalysis or blood chemistry shows demineralization, with a low phosphorous and calcium content, are unable to recover properly from these operations and will have exacerbations of the symptoms complained of without proper steps to provide means of building up the lost bony structure. A well-

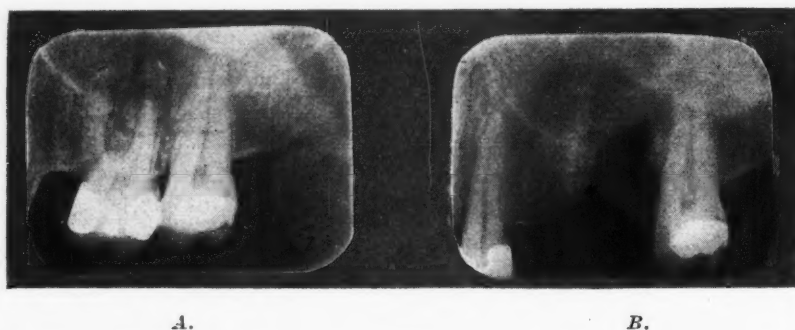


Fig. 17.—Case of Mr. G. A, Intraoral roentgenogram of the right maxillary first molar, showing periapical osteitis. After removal of this tooth, an opening was found into the maxillary sinus. The sinus was filled with chronic hyperplastic inflammatory tissue and the floor of the sinus showed a definite chronic osteomyelitis. B, Intraoral roentgenogram after removal of first molar.

balanced diet should be provided endeavoring to regulate the caloric content and to supply an alkalization diet. At least 30 ounces of orange juice should be taken daily. Additional calcium and phosphorus should be supplied.

It is necessary to supply the patient with vitamin D in the form of activated cod liver oil. This should be supplemented with plenty of outdoor exercise and sunshine. Sunshine is of particular advantage in these types of cases. A general sun bath daily, and exposing the area involved to the direct rays of the sun are particularly advantageous. During the winter months and at times when sunshine is not available this can be supplied by the use of carbon arc or quartz ultraviolet ray.

In operating these areas of primary chronic osteomyelitis in the maxilla not involving the maxillary sinus, it is well to provide a wick or drain and not attempt to suture them or close them immediately except in very simple operations. Quite often without a drain, there is a tendency to flare up and

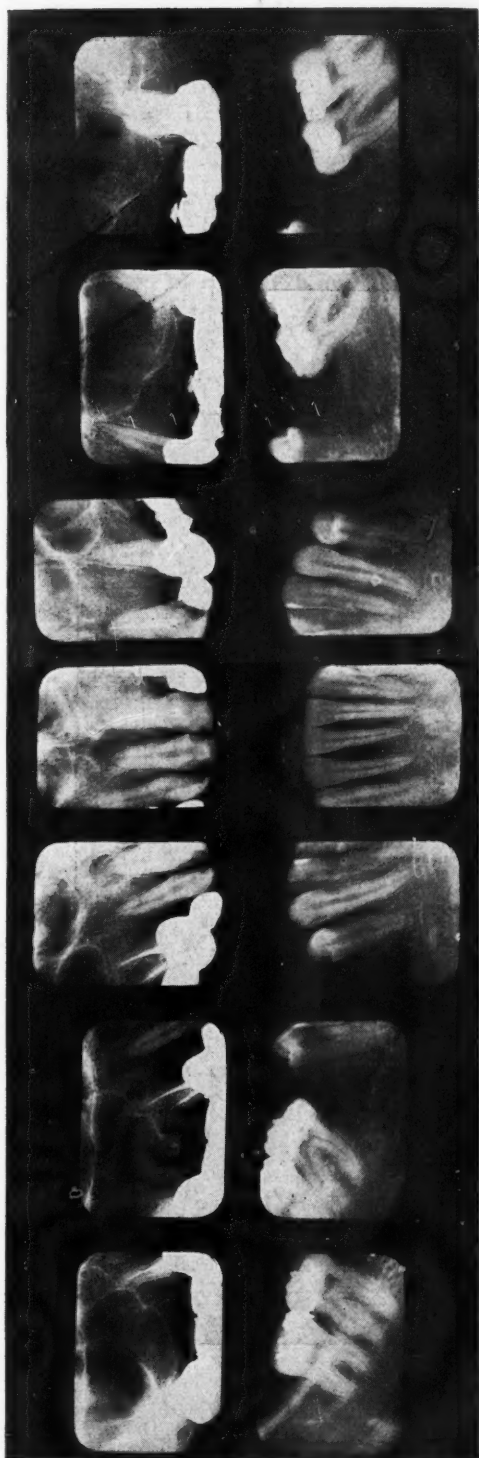


Fig. 18.—Intraoral roentgenograms. The right maxillary canine and molar abutments do not show any pathologic bone changes. However, all the maxillary teeth were removed, and the bone structure surrounding the right maxillary canine and molar was definitely diseased, the bone being soft, spongy and the disease extending into the maxillary sinus. The sinus was filled with chronic hyperplastic tissue. A large opening into the sinus which was difficult to close resulted from this operation.



Fig. 19.—Intraoral roentgenograms showing rarefied condition of maxilla extending from right canine to left second molar. This area of primary chronic osteomyelitis extended into the maxillary sinus. The sinus was filled with chronic hyperplastic tissue.



Fig. 20.-A.



Fig. 20.-B.

Fig. 20.-A, Photograph of plaster model of maxilla, showing growth in hard palate opposite the molars. B, Extraoral roentgenogram showing sclerotic bone in coronoid region. C, Extraoral roentgenogram from another angle. D, Photograph of two molar teeth and diseased bone removed. E, Photomicrograph of area of chronic osteomyelitis (x26). F, Photomicrograph of one section of diseased bone (240). G, Photomicrograph of another section of the diseased bone (x240).

give postoperative disturbance. All roots should be removed, as sooner or later it has been our experience that bone changes will occur around these roots.

Where the area of bone disease involves the floor of the sinus many rhinologists prefer to do a Caldwell-Luc operation for access to all walls of the sinus, but the objection from the dental standpoint of this type of incision and operation for this particular type of disease is that it does not give access to the particular area involved. Dr. Shearer had suggested an incision for operating the maxillary sinus, and the incision I suggest is based upon this type of opening. I find the best plan is for the dentist to make two incisions,



Fig. 20.-C.

one anteriorly and one posteriorly, so that all the mucous membrane can be reflected buccally over the premolar and molar teeth so that direct access can be had to the maxilla and the floor of the sinus. All diseased bone in the sockets of the teeth bordering the sinus can be removed and followed directly into the sinus where there is pathologic tissue. The openings can be enlarged into the sinus to enable the operator to visualize the sinus and to remove all pathologic tissue. Where there is no opening through the tooth socket, in some cases an additional opening can be made into the sinus above the roots of the teeth as in the Caldwell-Luc operation and the sinus cleaned in that way, removing all the pathologic bone tissue in the floor of the sinus. The mouth wound can then be sutured and further treatment carried on through the nasal opening.

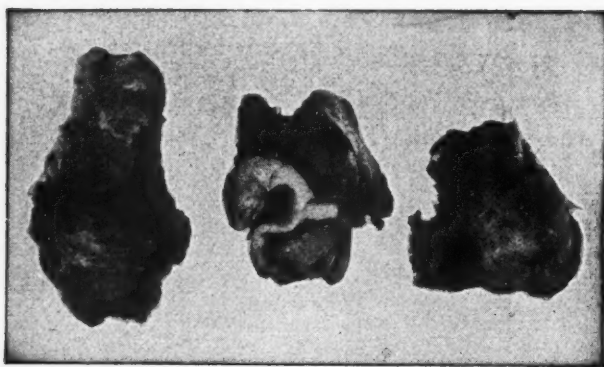


Fig. 20.-D.



Fig. 20.-E.

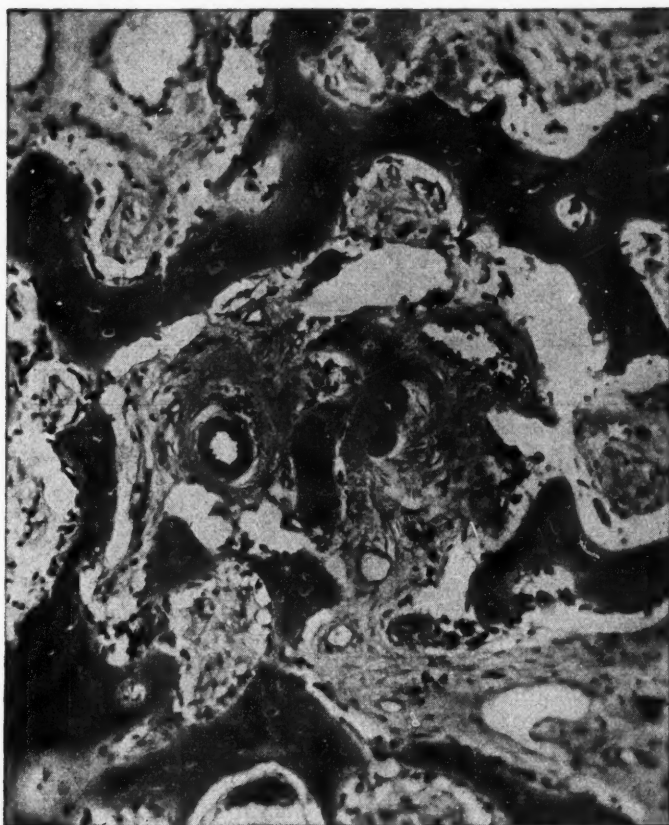


Fig. 20.-F.

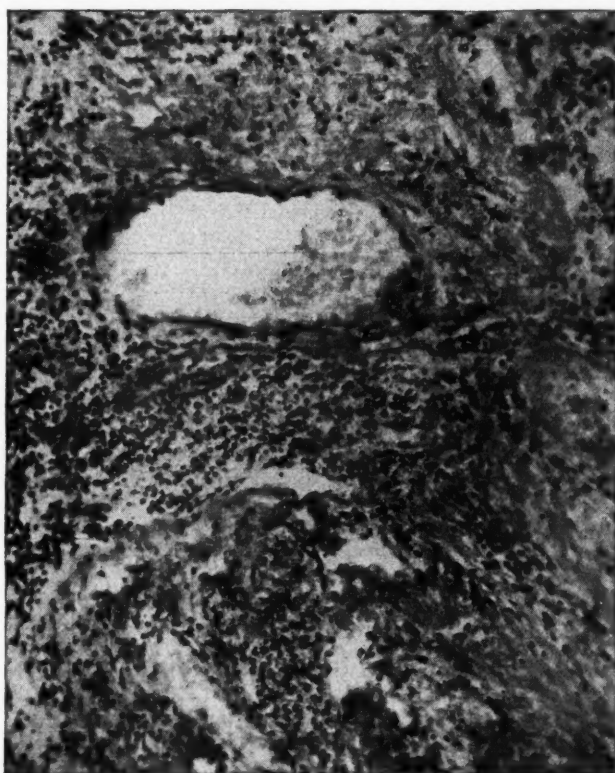


Fig. 20.-G.

It is well completely to close the mouth wound with silk suture. The rhinologist then makes an opening into the sinus below the inferior turbinate bone so that the sinus may be irrigated every day for a few days until the mouth wound heals, and in this way prevent the secretions and blood from dripping down through the mouth opening and thus prevent it from healing. In some cases where the opening is especially large, it is necessary to pack the sinus through the nasal opening with gauze to aid in closing the mouth wound.

TABLE I

DATE	NAME	P _H	CA	P	BLOOD COUNT		
					RBC	WBC	HEM
5/14/31	Mrs. E. C. W.	6.2	0.26	0.66	4,550,000	5,000	70
6/15/31		6.2	0.53	0.80	4,450,000	5,800	74
7/16/31		6.0	0.30	0.55	4,420,000	5,000	70
7/15/31		6.8	0.30	1.33	4,800,000	6,200	78
8/20/31		7.0	0.84	1.40	4,950,000	7,200	85
10/18/30	Mrs. W. F. R.	7.2	0.078	Trace	4,090,000	7,000	75
2/25/31		7.2	0.078	0.10	4,200,000	7,100	78
4/24/31		6.0	0.14	0.024	4,450,000	6,800	78
7/20/31		7.1	0.22	0.55	4,800,000	7,400	80
3/19/31	Mrs. L. C. G.	7.2	0.28	Trace	4,440,000	6,500	78
4/25/31		5.8	0.26	0.64	4,900,000	6,500	85
5/ 1/31		5.4	0.52	0.41	4,500,000	7,000	85
5/14/31		5.4	0.26	0.90	4,800,000	7,500	87
8/30/31		7.0	0.46	1.15	4,900,000	7,200	92
2/20/31	Mr. J. J. H.	6.2	0.29	1.05	4,400,000	13,600	74
3/25/31		5.6	0.15	0.95	5,900,000	9,950	77
6/25/31		7.2	0.39	0.96	5,200,000	7,700	96
2/10/31	Miss V. F.	7.0	0.07	0.17	4,150,000	7,000	78
4/ 7/31		7.0	0.30	1.00	4,500,000	7,200	80
5/16/31		6.8	0.14	0.60	4,250,000	7,000	75
7/16/31		7.0	0.28	1.10	4,500,000	7,500	90
3/18/31	Mrs. A. C.	6.2	0.14	0.26	4,750,000	10,400	68
3/21/31		6.8	0.15	0.26	4,750,000	9,400	72
4/11/31		5.8	0.16	0.40	4,500,000	8,500	76
6/29/31		7.0	Trace	0.066	4,250,000	7,500	80
8/ 1/31		7.2	0.28	0.80	4,800,000	7,600	88

P_H, Hydrogenion to determine acidity of alkalinity. CA, Calcium. P, Phosphorus. RBC, Red blood count. WBC, White blood count. HEM, Hemoglobin.

Table I shows a tabulation of the findings of the six cases classed as failures from a purely operative standpoint out of the fifty cases studied.

CASE 1.—Mrs. E. C. W., aged forty-eight years, housewife, presented with the following history: About two years before, probably March, 1929, she went to her dentist and had the left maxillary tooth extracted. In about three days an infection set in. The dentist operated and took out a piece of bone and said it was diseased. The wound healed partially but left a sore place where the ragged edge of the bone was irritating.

About June or in the summer of 1929, she went to another dentist and he made x-ray pictures and sent her to a rhinologist who punctured the sinus and found no definite disease but stated it was necessary to have a bone operation and that it would take months to heal. She let it run on and took a great deal of aspirin to relieve the pain.

In April, 1930, she came to me, and a lipidol roentgenogram showed a hyperplastic sinusitis.

The rhinologist removed tonsils and operated upon the antrum, and I extracted a right maxillary first tooth and curetted the bone.

Her condition thereafter would quiet down and start up again.

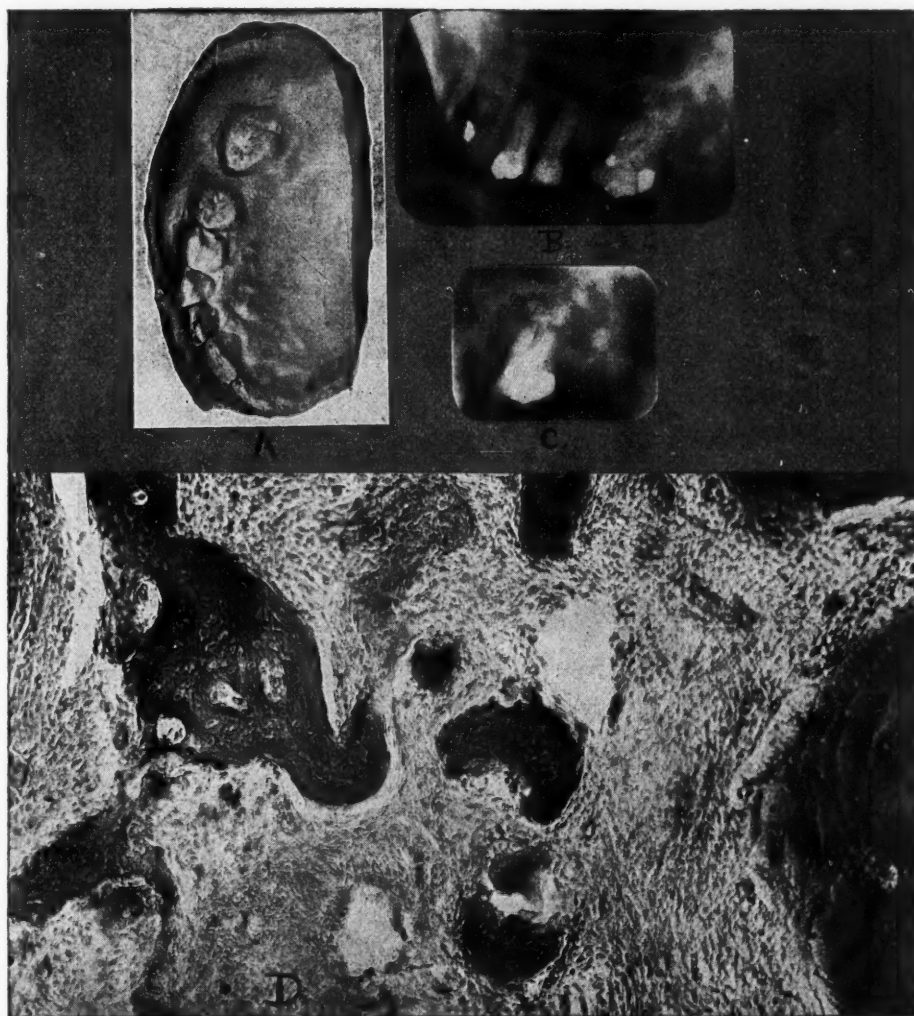


Fig. 21.—Case of Mrs. G. A. A, Photograph of impression of the mouth, showing hypertrophy in the premolar and molar regions. B, Intraoral view showing honeycombed condition with areas of rarefying osteitis and osteosclerosis. C, Small intraoral view showing molar region. D, Photomicrograph. Section made through the decalcified tooth, and its accompanying attached alveolar processes show considerable thickening of the cancellated trabeculae with narrowing of the Haversian canals and the bony lacunae, accompanied by a very marked fibrosis of the tissue of the cancellated marrow spaces. The periodontal membrane is markedly thickened and sclerotic. In certain areas throughout the marrow spaces of the bone there is evidence of a low grade chronic inflammation characterized by patchy round-cell infiltration and endothelial proliferation of the preformed blood vessels. No evidence of any malignant change can be demonstrated. The microscopic picture is that of a chronic plastic sclerotic process resulting from chronic irritation of long standing.

When she returned to me May 14, 1931, she still complained of pain and discomfort over the side of her face.

Since diet control and direct sunlight treatment, she has been free of these disturbing symptoms.

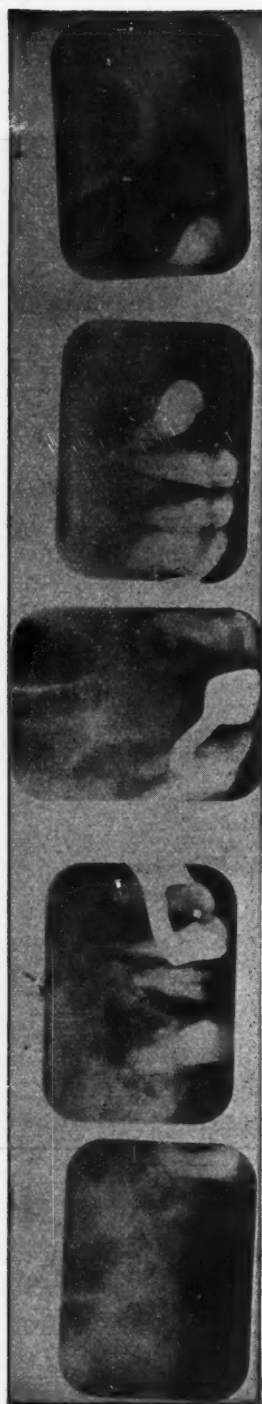


Fig. 22.—Intraoral roentgenograms of the maxillary teeth showing chronic plastic, sclerotic process resulting from long-continued irritation of chronic osteomyelitis.

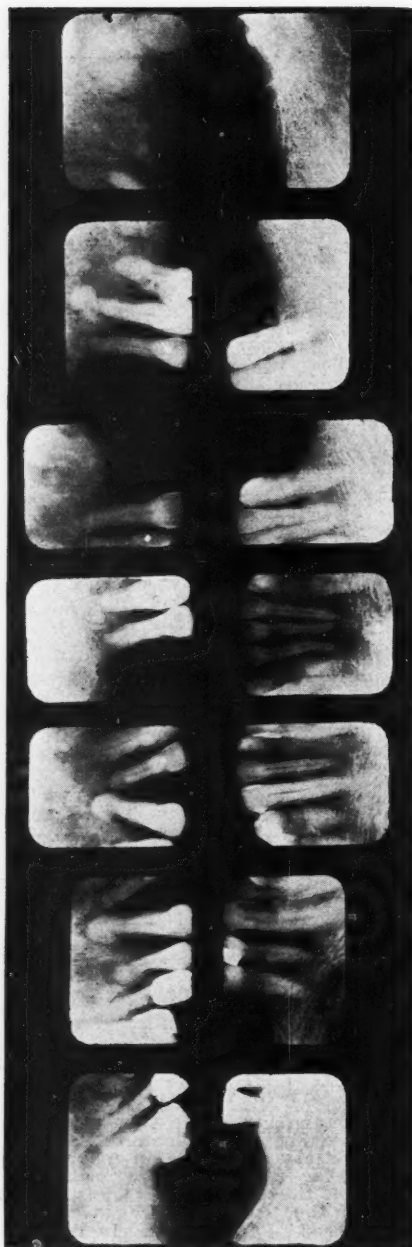


Fig. 23.—Intraoral roentgenograms showing primary chronic osteomyelitis of maxilla, involving all the teeth.

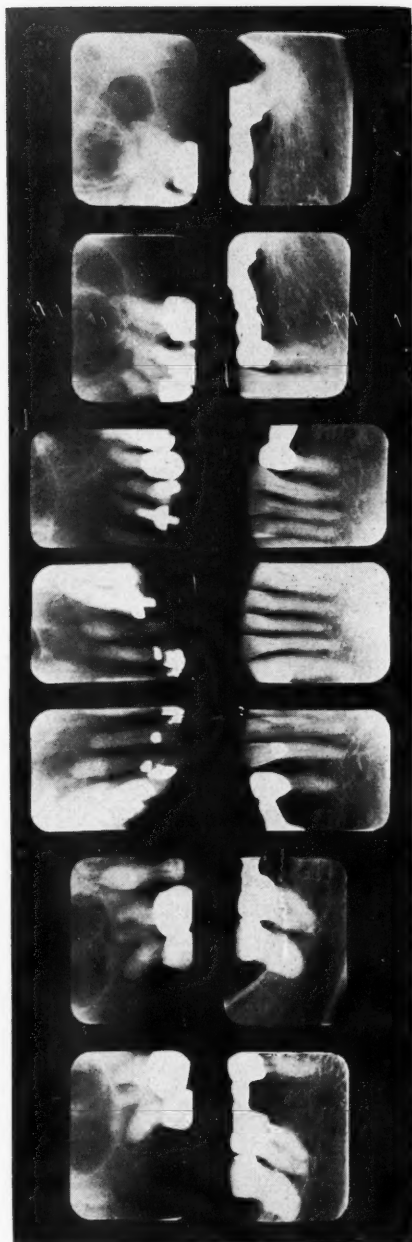


Fig. 24.—Intraoral roentgenograms showing chronic osteomyelitis of maxilla involving all the teeth.

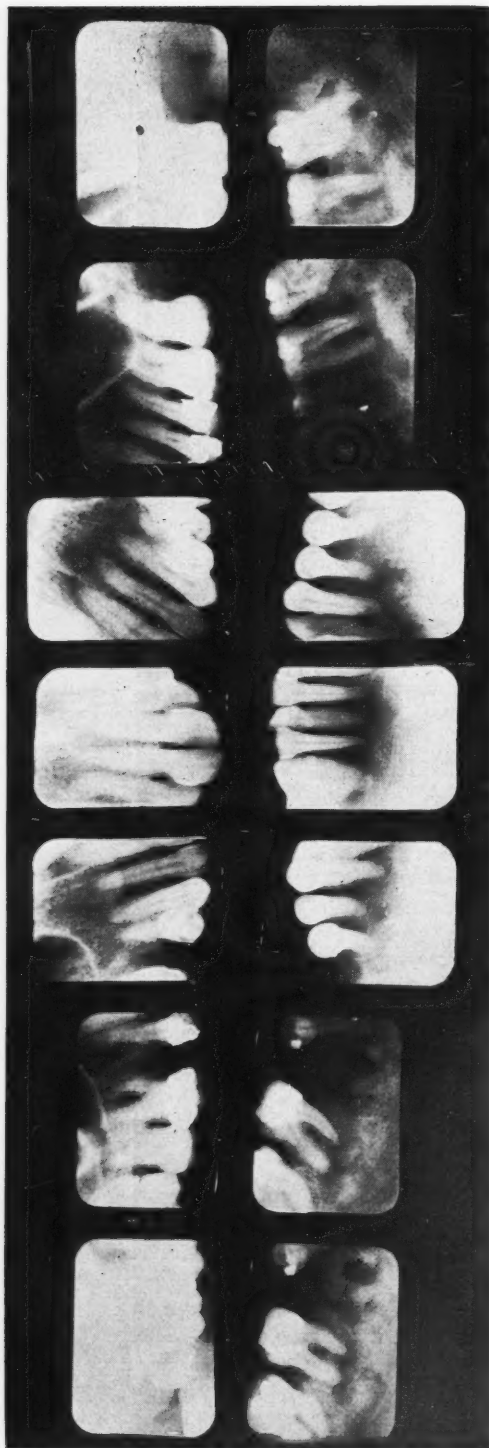


Fig. 25.—Intraoral roentgenograms showing typical pictures of primary chronic osteomyelitis of the mandible. This, however, does not appear to be an infective process. The teeth are all vital, firm and of good appearance. I have made roentgenographic check-ups in this case, and there has been no change in the last four years. The general physical examination does not aid in determining the etiology of the disease in this particular case. It is possibly due to a diet deficiency.

CASE 2.—Mrs. W. F. R., aged thirty-six years, housewife, presented for examination on January 2, 1931. She complained of intense discomfort in the region of the left infraorbital foramen, with pain radiating to the eye, back of the ear and in the back of the head. The pain was somewhat similar to a mild facial neuralgia.

Intraoral roentgenograms showed two roots in the left maxillary second molar region, which were encapsulated and showed no definite picture of infective osteitis. The molar teeth on this side were missing. The first premolar was pulpless and had a root filling but showed no definite bone change. The second premolar did not have a root filling but had a small area of rarefying osteitis at the apex. The lateral incisor was missing. The central incisors were both vital, and there was a small cavity in the left central incisor.

Transillumination of the teeth and sinuses was negative. Posteroanterior x-ray pictures of the maxillary sinus were negative, as well as was lavage. Physical examination did not disclose any physical defects. A primary chronic osteomyelitis was suspected from the symptoms presented, and an exploratory incision advised as well as the removal of the two roots and both premolars.

On January 3, 1929, the two teeth and two roots were removed and a flap operation disclosed a definite honeycombed infective area which extended into the maxillary sinus. The floor of the maxillary sinus was filled with chronic hyperplastic tissue and polyps. The rhinologist and I removed this tissue through the mouth wound.

She received prompt relief but on January 31, 1929, upon her complaint of severe distress another exploratory incision was made and more inflammatory tissue was found, showing an extension again from the maxillary sinus. She received relief for considerable time.

On July 4, 1929, after her return with severe symptoms of pain, a radical sinus operation was performed, and the wound again opened. The area of bone disease was very extensive. The mouth wound was closed, and the maxillary sinus packed with gauze through an inferior turbinate puncture and was irrigated daily through this opening.

She did not get relief for about two months, but after exposure of her face to direct sunlight and rest, she apparently got complete relief which lasted until October 29, 1930, when she returned with the same old symptoms.

She was put upon a liberal diet and her calcium and phosphorus metabolism were corrected and her blood picture built up.

She has periods of apparent relief but returns with some of the old symptoms.

She does not cooperate fully in regard to her diet and additions thereto, and other forms of treatment.

While she is improved, her case is not an absolute cure.

CASE 3.—Mrs. L. C. G., aged forty-two years, housewife, presented February 8, 1930, with impacted left maxillary third molar with slight pericoronal rarefying osteitis. She complained of neuralgic pain over the left side of the

face and back of the ear, and a general feeling of malaise. The impacted molar was removed and an area of chronic osteitis and osteomyelitis found involving the floor of the maxillary sinus with hyperplastic sinusitis. The diseased tissue was removed and the mouth wound closed. The rhinologist made an inferior turbinate window for irrigation.

She received relief but presented again on August 13, 1930, for the removal of a vital left maxillary first molar with a slight periodontal pocket. Soft and spongy bone of an infective type was again found.

On January 23, 1931, an impacted maxillary right third molar was removed.

On March 18, 1931, patient complained of vital left maxillary canine and of discomfort over entire left side of face.

Patient has complete relief of symptoms since following our plan of diet control.

CASE 4.—Mr. J. J. H., aged thirty-three years, salesman, presented for treatment on February 20, 1931, with a chronic osteomyelitis of both the right and the left maxillary molar region involving the maxillary sinuses. These areas were operated in the mouth and the infective rarefying osteitis was found to extend into the floor of the sinus. There was only a small amount of hyperplastic tissue in the floor of the sinus. This was the third occurrence within two years of this osteomyelitis, during which time he received only temporary relief from disturbing symptoms.

After correcting metabolism of calcium he is free from disturbing symptoms.

CASE 5.—Miss V. F., a stenographer, aged thirty-six years, presented February 28, 1930, with a history of pain and discomfort in the right side of the face, which had existed for a period of over two years after the removal of her teeth. The pain radiated to the eye and to the back of her neck. She complained of a sense of fullness under the right eye, with a pressure back of the eye.

A diagnosis of chronic osteomyelitis was made. A radical sinus operation was performed by the rhinologist; at which time I removed the diseased tissue in the right maxillary molar region, which extended into the floor of the maxillary sinus. Definite hyperplastic infection tissue was found.

She received some relief but continued to return complaining of the above symptoms.

After correction of her diet and attention to her calcium and phosphorus metabolism, and building up her blood picture these disturbing symptoms have disappeared. She has gained in weight and health.

CASE 6.—Mrs. A. C., aged forty-eight years, housewife, came to me on January 28, 1931, complaining of left maxillary molar region. She had pain over this side of the face with pain radiating above the eye and back of the ear and a sense of discomfort over the entire side of the face. I turned a flap and made an exploratory incision and found a residual infection in the maxillary second premolar area involving the maxillary sinus.

On February 14, 1931, a rhinologist operated the maxillary sinus, made an inferior turbinate puncture and I closed the mouth wound. On March 4, 1931, I removed the remaining maxillary teeth, which were the left maxillary molar, first and second molars, the right central and lateral incisors, canine and first premolar and first molar.

After the removal of teeth at different periods patient received a certain amount of relief.

This patient did not receive complete relief from operative procedures until the metabolism of calcium and phosphorus was corrected and her blood picture corrected.

CONCLUSIONS

1. Primary chronic osteomyelitis is a type of bone disease occurring rather frequently in the maxilla and in many instances involving the floor of the maxillary sinus, and the maxillary sinus itself.

2. Primary chronic osteomyelitis is a disease which is often very difficult to diagnose.

3. In the treatment of chronic osteomyelitis of the maxilla involving the maxillary sinus the complete cooperation of the rhinologist, the oral surgeon and the general physician is of great importance.

4. The necessity of a complete physical examination by the physician and his assistance in the preparation of a diet adapted to the patient have been shown.

5. Sunlight has proved to be an aid in the treatment of these diseases.

6. In the series of fifty cases outlined, there were six cases classed as failures from a purely operative standpoint which improved with a balanced diet supplying adequate amounts of calcium and phosphorus and cod liver oil building up the blood picture with tonics and using sunlight.

7. There appears to be ample clinical proof that chronic osteomyelitis may be associated with a dietary mineral deficiency providing a susceptible field for the invasion of microorganisms.

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CHRONIC INFLAMMATION OF THE SALIVARY GLANDS WITH OR WITHOUT CALCULI*

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Section on Laryngology, Oral and Plastic Surgery, The Mayo Clinic

AND

FREDERICK R. HARPER, M.D., ROCHESTER, MINN.

Fellow in Surgery, The Mayo Foundation

THE symptoms and the clinical picture of chronic inflammation of the salivary glands are sometimes not recognized by either internist or surgeon, with the result that mistakes in diagnosis and treatment are often made. The disease does not necessarily have to be associated with the presence of a stone in the gland or duct, and the stone, if present, is not always demonstrable by the roentgenogram.

We are reporting here 110 cases of nonspecific inflammation of the salivary glands, in 70 of which salivary calculi were present also. We have excluded from this group all cases in which tuberculosis, syphilis, and actinomycosis were the etiologic factors, also cases of acute and postoperative parotitis and cases in which there were malignant lesions about the mouth or face.

SYMPTOMS

Although the clinical grouping of chronic inflammatory conditions of the salivary glands usually includes the presence or absence of a stone, from a clinical standpoint this makes little difference. Patients with chronic inflammation of the salivary glands usually present themselves for examination first, because of exacerbation of acute infection in an old chronic inflammatory salivary gland, and, second, because of obstruction of the duct by a small stone blocking the drainage of saliva. The most common complaint is the repeated exacerbations of acute infections rather than the symptoms of obstruction from a stone.

In all cases of salivary calculi, one can express pus or mucopus from the duct, and it is the acute exacerbation of this infection which is the most common symptom for which the patients present themselves. Some patients have had tonsils or third molars removed in an attempt to get rid of the repeated submaxillary inflammatory condition. So-called salivary colic due to the swelling of the salivary gland behind the stone, accompanied by sudden severe pain in the floor of the mouth, tongue, and side of the throat, occurring during meals or sometimes with the mere sight of food, is an occasional symptom, but not the most common in this group of cases. Most of the patients have had symptoms extending over months or years, the average being four to five years; 39

*Reprinted from Surg., Gynec. and Obst., October, 1931.

per cent gave a history of previous attacks. The severe attacks of pain usually described as being pathognomonic of submaxillary stone rarely occur. Only 62 per cent of our patients noticed any pain, and most of them described the pain as mild. After an acute infection, pus usually discharges into the mouth; this relieves the patient of the pain and swelling, and he may not have another attack for months or years. A chronic inflammatory condition of the submaxillary salivary gland, in the absence of calculi, is usually due to a chronic condition following an acute abscess of the salivary gland. This may entirely clear up or continue to drain as a chronic productive type of infection. Of the 40 patients with chronic inflammatory salivary glands without calculi in our group, 14 (35 per cent) gave a history of intermittent swelling, and 7 (17 per cent) stated that the swelling was brought on at mealtime. Although pus can

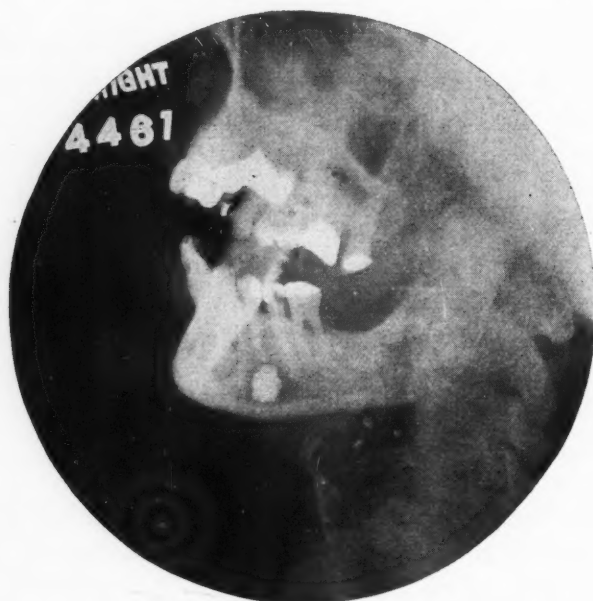


Fig. 1.—Retouched roentgenogram. The large stone in the submaxillary duct and the multiple stones in the submaxillary salivary gland may be seen.

be expressed from the duct, it usually is thin. Infection may recur in this group, although between these exacerbations the gland gives little trouble other than its enlargement.

INCIDENCE

In 70 of the 110 cases salivary calculi were present and in 40 no calculi were found. Calculi of the salivary glands or ducts are considered by most observers to be very uncommon. Erdman, in 1920, found 300 cases in the literature, and Harrison, in 1926, raised the total number to 375 and added 27 cases of his own.

Calculi are found most often in the submaxillary gland or duct and less often in the sublingual gland. Wakeley reported the percentage of incidence according to the gland or duct involved as: submaxillary, 63.2 per cent; parotid, 20.6 per cent; and sublingual, 16.2 per cent. In our series of cases, there is a larger portion in the submaxillary gland; that is, the submaxillary

gland or duct, 66 (92.9 per cent); the parotid gland or duct, 3 (4.3 per cent); and the sublingual gland or duct, 2 (2.8 per cent). Although Wakeley, after careful search of the literature, was able to find references to only 3 cases in which the calculi were present in more than one gland or duct in the same person, we noted in one case the presence of calculi in both the submaxillary and sublingual ducts, and in one case both submaxillary glands were involved. The right submaxillary gland is affected almost twice as often as the left. We are unable to account for this coincidence, and we did not find any reference to this observation in the literature.

The condition occurs in middle life. According to Wakeley, more men are affected than women (proportion 2:1). Carter put the proportion as about 5:1. In our 70 cases of chronic inflammation of the salivary gland with stone, 45 patients were males and 25 were females. In the 40 cases of chronic inflam-



Fig. 2.—Retouched roentgenogram. The rounded stone in the submaxillary salivary gland may be seen.

mation of the salivary glands without stone, the submaxillary gland was also the most commonly affected. On the other hand, the acute postoperative inflammations that are commonly seen after operations on the upper part of the abdomen are usually situated in the parotid gland rather than in the submaxillary. The distribution of our cases was: submaxillary gland, 32 (80 per cent); parotid gland, 5 (12.5 per cent); and the sublingual gland, 3 (7.5 per cent). In this group, as in the cases in which calculi are present, males are affected about twice as often as females. In our series of 40 cases without stone there were 27 males and 13 females; their ages were about middle life. There were only 3 cases of parotid calculi in our series; in 1 case they occurred in the gland itself, and in 2 cases in Stenson's duct. In these 3 cases there was a history of long duration, with intermittent swelling and slight pain. In each case a single calculus was found. Wakeley stated that multiple parotid calculi are more common than single. He also stated his belief that formation of the

abscess is common around long standing calculi, and that in case an abscess opens externally a fistula generally results. There were 2 cases of sublingual calculi, and in 1 of these a stone was present in both submaxillary and sublingual glands (Figs. 1, 2, and 3).

ETIOLOGY

Wakeley, in a study of calculi in the submaxillary region, found that they were 75 per cent calcium carbonate and 10 per cent calcium phosphate. Saliva from the submaxillary salivary glands permits calcium salts to be seen more easily than does the saliva of the parotid or lingual gland, due to the high percentage of solids and organic matter, the greater degree of alkalinity, and the low content of carbon dioxide. Tartar usually forms about the lingual surface of the mandibular anterior teeth, and it is probably the same factor that pro-

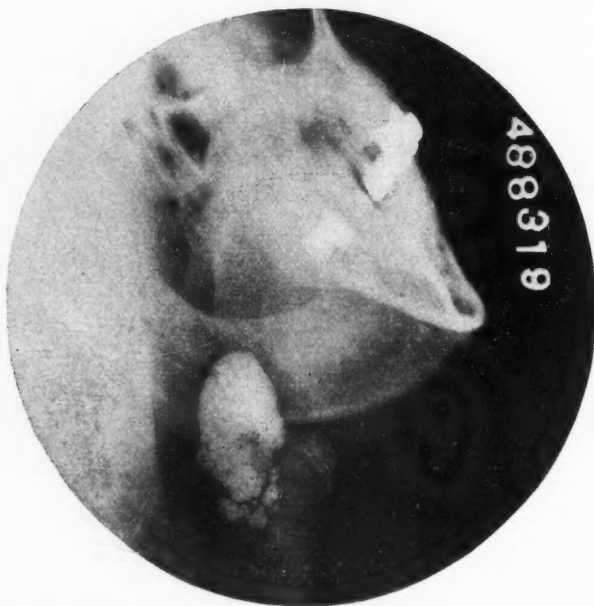


Fig. 3.—Retouched roentgenogram. The multiple stones in the submaxillary salivary gland, and one very large stone may be seen.

duces the stones in the submaxillary glands and ducts. Roberg, who investigated 47 cases of salivary calculi, stated that foreign bodies and salivary calculi often are present in the duct. Wakeley showed a fishbone found in a Stenson's duct with salivary calculi around it. Foreign bodies in the salivary ducts are rarely seen and probably are not factors in the production of salivary calculi. The stones may form around organic matter or bacteria in the gland substance of the duct.

PATHOLOGY

The size of salivary calculi varies from a few millimeters in diameter to 3 to 5 centimeters as reported by Garretson. Orth described a stone weighing 70 grams. Although it is rare to find more than one stone in a single gland or duct, Noehren reported a case with fourteen stones in Wharton's duct and Söderlund found thirty in the submaxillary duct. In 8 of our cases stones

were multiple. In 4 cases there were two or three stones in the submaxillary gland. In 3 other cases there were multiple stones in the submaxillary duct.

The pathologic changes in these cases have been considered by Henke and Lubarsch. The obstruction resulting from stone in the duct causes congestion of the mucosa of the ducts with petechial hemorrhages. In case a large stone is present, erosion and ulcer may result. These processes lead to the formation of granulations with resulting fibrosis and more complete obstruction. As a result of the obstruction to secretion the intralobular ducts become congested and dilated; this is followed by atrophy of the tissue of the gland. After obstruction, infection results readily, often forming a phlegmon in the gland and surrounding structures.

Henke and Lubarsch mentioned that stones may be extruded by the formation of a fistula which communicates with the surface of the skin. This was found in 3 of our cases. Roberg was unable to find references to salivary fistulas other than those connected with Stenson's duct. Harrison reported 1 case in which a salivary fistula was connected with Wharton's duct. Only 4 cases of external fistula were noted in our entire series, and all were associated with the submaxillary gland. A diagnosis of branchial sinus was made in 1 case, and thyroglossal sinus in 2 cases, because the opening of the sinus was close to the median line.

Henke and Lubarsch described two types of chronic inflammation of the salivary glands without stone, the chronic exudative and the chronic productive. Chronic exudative inflammation often follows acute inflammation and may be associated with it. The gross picture is that of swelling and enlargement of the gland, associated with abscess. Microscopically, there is lymphocytic and plasma cell infiltration associated with a lesser degree of leucocytic infiltration. The purulent material forms around granulation tissue resulting in the formation of abscess.

METHODS OF DIAGNOSIS

In the examination of a patient presenting an enlarged submaxillary gland, a bimanual examination should be made. In 92 per cent of our cases in which stones were present, pus could be expressed from Wharton's duct. The opening of the duct is usually red and thick, and if a stone is present, it can usually be felt with the forefinger. We do not believe that probing the duct is advisable, as this frequently tends to stir up secondary infection by traumatizing the duct and does not aid in the diagnosis. The roentgen-ray examination should always be used to confirm the clinical diagnosis, and in cases in which the stone is lodged in the gland itself with much thickening, it may be the only positive way of finding the stone. Erdman considered the roentgen-ray examination of little value, whereas Harrison found it of positive value in 75 to 85 per cent of his cases. In 80 per cent of our cases in which stones were present, they were demonstrated in the roentgenogram. Hickey described improved technic for demonstrating these calculi. The patient is allowed to lie supine on the table with the head projecting over the end. A large film is placed in the

mouth and held in position by closing the teeth. The roentgen-rays are directed from above downward, with the central ray passing through the center of the mouth.

Differential diagnosis in this group must include chronic submaxillary lymphadenitis, actinomycosis, carcinoma of mixed tumor type, and specific inflammatory lesions, such as syphilis and tuberculosis.

TREATMENT

The treatment depends on the condition at the time the patient comes for examination. If there is an acute infection, as there often is, the use of hot irrigations and hot dressings is the advisable treatment until the acute condition subsides. Probing the duct or any manipulation at this time not only is not beneficial, but frequently increases the cellulitis and is a very dangerous procedure. After the acute condition has subsided, roentgenograms are made to exclude the presence of a stone. If a stone is present and is situated anteriorly in the gland or in the duct, removal through the mouth is the treatment of choice. Removal of the stone, however, may not clear up the condition of the gland, because of the nature of the gland and the multiple pockets of inflammation that may be present.

In 30 of our series of 70 cases of chronic inflammation of the salivary gland with stone, the stone was removed from the duct. In 13, the stone was removed from the body of the gland through the mouth. In the remaining 27, on account of the situation of the stone and the amount of infection present, it was thought best to remove the entire gland. Of the 30 cases in which the stone was removed from the duct there were 4 (13 per cent) in which there was recurrence of symptoms. In the 13 cases in which the stone was removed from the body of the gland there were 3 (23 per cent) in which there was recurrence of symptoms. In the cases in which the entire gland was removed, there was no further trouble. So in 43 cases in which the stone was removed from the duct or the gland through the mouth, there were 7 (16.3 per cent) in which symptoms recurred. If, however, there is a great deal of infection present in the gland and a long history of recurring suppuration, it is useless to expect this to be entirely cleared by removal of the stone alone. It is this type of case in which removal of the entire gland is the advisable treatment.

In the group of 40 cases of chronic inflammation without stone, 18 patients had received treatment before examination at the clinic. Drainage from the outside was instituted in 13; drainage through the duct, the duct having been probed, in 3; and a stone had been removed from the duct in 1 case. In this latter group of cases, if the exacerbations are giving sufficient trouble, the only treatment advisable is removal of the entire gland if the condition is present in the submaxillary region. The entire gland was removed in all except 2 of our cases, without recurrence in any. In a small group of cases in which the parotid gland has been involved, vaccine has been used, but the results have been rather indifferent. In some cases much benefit has resulted. Treatment by roentgen-rays has been advocated in cases in which the parotid gland was involved in order to destroy the substance of the gland.

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ABSTRACT OF CURRENT LITERATURE

NUTRITION AND PEDIATRICS

BY SAMUEL ADAMS COHEN, M.D., NEW YORK CITY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Acute Suppurative Parotitis. R. P. Custer. *Am. J. M. Sc.* **182**: 5, 1931.

Custer of Philadelphia reviews the literature on acute suppurative parotitis and reports two cases which he followed at the Pathologisch-anatomisches Institut der Universität Innsbruck, in Austria. Since Virchow's description of this condition there has been a difference of opinion as to the route of infection. Most authors including Custer are of the opinion that the invading organism ascends through the duct and secondarily invades the gland tissue; others hold that the source of infection in acute suppurative parotitis is hematogenous. Other routes of infection include extension from surrounding tissue and the possibility of lymphogenous infection from nose and throat. As in other similar clinical situations the clinical picture usually points out the route of infection.

Although acute suppurative parotitis occurs as a complicating and often as a terminal infection in a wide variety of conditions, the literature reports that this entity is seen more often following abdominal operations (particularly those performed in septic areas). This condition has also been observed during the course of many acute and subacute infectious diseases, the most outstanding being typhoid fever. Suppurative inflammation of the parotid has been observed in the newborn and also in suckling infants.

In his discussion of some of the local predisposing causes which favor the ascent of infection into the gland, Custer states that in generalized infections as well as in conditions of chronic disability there occurs a lowering of the general body resistance, and often with it a relative increase in virulence of the normal bacterial flora of the mucous membrane. He believes that the dehydration and the diminution of the salivary flow during a febrile state are also important predisposing causes. Pavlov is quoted as the authority for the opinion that reflex cessation of salivary flow, to a more or less complete degree, accompanies laparotomy and visceral manipulation.

The mortality of this condition is fairly high; estimations vary from 30 per cent to 42.8 per cent.

Effect of Vitamins A and D on Resistance to Infection. Lyman C. Boynton and W. L. Bradford. *J. Nutrition* 4: 3, 1931.

Boynton and Bradford report their observations on animal experiments of the effect of vitamins A and D on resistance to infection. They mention the fact that there is an abundance of experimental investigation to show that laboratory animals in advanced stages of vitamin A deficiency suffer from spontaneous infection. Infections of the urinary tract, mastoid, nasal sinusitis, purulent otitis media, respiratory and alimentary tracts are fairly common end-results in these animals. On the other hand the literature indicates that the evidence is only suggestive that there is a lower resistance to infections of animals deprived of vitamin D.

Reporting their own experimental work from the University of Rochester School of Medicine and Dentistry these investigators likewise found that there is a definitely increased susceptibility to infection in rats fed on vitamin A-free diet as compared with their controls. To a lesser degree the same holds true when experimental animals were put on a vitamin D-deficient diet.

Boynton and Bradford also make the interesting observation that whereas in these animals it takes from six to eight weeks to deplete the body stores of vitamin A "yet marked susceptibility to infection was evident as early as the fourth week on the deficient diet."

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Opinions—Neither the editor nor the publisher holds himself responsible for the opinions of contributors, nor is he responsible for other than editorial statements.

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EDITORIAL

Orthodontic Fees

IT VERY often happens that a general practitioner will refer a patient to an orthodontist. The general practitioner may make a request to have the fee made as low as possible, and in other instances no request is made. In either case, it often happens that after the fee has been named, the general practitioner will inform the patient that he considers the fee rather high. This statement is often made without any consideration of the time involved in rendering the orthodontic service or of the importance of the service.

Furthermore, the criticism is often made without any relative comparison between the time spent in treating a case of malocclusion and the expense incurred during that time, and the time, expense and skill incurred in rendering service in the field of general dentistry. For example, it recently came to our

attention that an orthodontist had named a fee for orthodontic service, and informed the patient that there would be a \$150 appliance fee. The dentist, without consulting the orthodontist, informed the patient that he thought the appliance fee was too high.

A careful analysis of the time spent by an orthodontist in taking impressions, making the model, and constructing the maxillary and mandibular appliances will reveal the fact that he is receiving a much smaller fee for the time spent than is paid the average practitioner for a similar amount of service.

We do not believe that the general practitioner realizes the amount of time that is consumed in making a maxillary and a mandibular appliance. We also consider it very unfair for the general practitioner to tell his patient that he believes the appliance fee is too high, because if the orthodontist were so inclined, he could very easily make the same statement to the patient about the general practitioner.

We have known instances where dentists have complained about \$150 being too high a fee for an orthodontic appliance when the dentist would charge his patients \$500 or \$600 for a small removable bridge or denture. A study of the fees charged by the mechanical laboratories revealed the fact that the dentist had paid the laboratory much less for the construction of this restoration than the materials would cost in the average maxillary and mandibular orthodontic appliances.

We do not know of any orthodontist who would be so unethical as to criticize the fees charged by the general practitioner, but we are sorry we cannot make the same statement for all general practitioners. Before any general practitioner criticizes the fees charged by an orthodontist, he should familiarize himself with the amount of time and expense involved in the construction of an appliance and in rendering the service which goes with orthodontic treatment.

NEWS AND NOTES

The Dental Society of the State of New York

The Dental Society of the State of New York will hold its sixty-fourth annual meeting May 11, 12, 13, 1932, at Hotel Ten Eyck, Albany, New York. A cordial invitation is extended to all members of state societies, Canadian societies and ethical dentists.

The officers and committees will present a program which we trust will enlist the attention of all dental practitioners.

Dr. E. J. Burkhart, 800 East Main Street, Rochester, N. Y., is Chairman of the Program Committee; Dr. E. W. Briggs, 1116 Madison Avenue, Albany, N. Y., Chairman of the Exhibits Committee; and Dr. E. Burley, 80 Fourth Street, Troy, N. Y., Chairman of the Clinics Committee.

For further information address the Secretary, Dr. A. P. Burkhart.

DR. A. P. BURKHART, Secretary,
57 E. Genesee St.,
Albany, N. Y.

The Southwestern Society of Orthodontists

The twelfth annual meeting of the Southwestern Society of Orthodontists will be held at the Herring Hotel, Amarillo, Texas, January 25, 26, 27, 1932.

The meeting will be held in conjunction with the Panhandle Dental Society. All members of the American Dental Association and members of the various orthodontic societies are cordially invited.

DR. WM. B. STEVENSON, President,
Fisk Medical and Professional Bldg.,
Amarillo, Texas.

DR. CURTIS WILLIAMS, Secretary,
716 Medical Arts Building,
Shreveport, La.

Federated Guilds of St. Apollonia

The following resolution was passed at the third national convention of the Federated Guilds of St. Apollonia which was held in Buffalo during the week of November 8.

"In view of the fact that the American Dental Association has an ethical code of advertising and that it has been brought to the attention of this Convention that very many Catholic papers and periodicals are opening their pages to unethical commercial advertising, the Convention hereby resolves to memorialize the Catholic Press Association about the evil, and each local Guild pledges itself to an active campaign, according to local conditions, to help toward the elimination of any abuses called to its attention."

DR. JOSEPH J. STAHL, Secretary,
Williamson Bank Building,
Buffalo, N. Y.

Virginia—West Virginia Joint Meeting

The next annual meeting of the Virginia State Dental Association and the West Virginia State Dental Society will be held jointly at Winchester, Va., May 16, 17, 18, 1932.

Preliminary plans are well under way, and one of the largest and most interesting meetings ever held in the South Atlantic Section is predicted by the officers. Members of the American Dental Association are cordially invited to attend.

DR. R. B. SNAPP, General Chairman,
Winchester, Va.

Annual February Clinics of the Dental Clinic Club of Philadelphia

Because of the popular demand the annual February Clinics of the Dental Clinic Club of Philadelphia this year will consist of a course in oral surgery, exodontia, anesthesia and radiography only.

The course is scheduled to begin Tuesday morning February 16, 1932, at 9 A.M. and will continue through Wednesday, Thursday and Friday, concluding at 5 P.M. on Friday, February 19.

The lecturers and clinicians for the course will include the following prominent and outstanding men in the profession:

Dr. Robert Ivy,
Dr. Lawrence Curtis,
Dr. L. Biddle Duffield,
Dr. George Davis,
Dr. John Gunter,
Dr. Roy Ennis,
Dr. James E. Aiguier,
Dr. W. J. Asprey,
Dr. D. C. Turkington,
Dr. M. Hagopian.

The fee for the course is \$25.00. Due to the expected heavy registration, it has been decided to limit the memberships to the course. Please send your reservations accompanied by check at an early date to Dr. John H. Yearick, secretary, 4908 Wayne Avenue, Philadelphia, Pa.

The American Board of Orthodontia

A meeting of the American Board of Orthodontia will be held at the Royal York Hotel, Toronto, Ontario, on May 16 and 17, 1932.

Those orthodontists who desire to qualify for a certificate from the Board should secure the necessary application form from the Secretary. The application must be returned to the Secretary, together with any other required credentials, at least sixty days prior to date of examination. In order to expedite the examinations the Secretary will designate the hour at which the applicant may appear before the Board on one of the above mentioned days. Applications filed at the time of Board meeting will have preliminary consideration, so that applicant may be advised of work required for his subsequent examination.

Attention is called to the following resolutions adopted by the Board:

Any person desiring to make application to the Board for a certificate shall have been in the exclusive practice of orthodontia for a period of not less than five years or an equivalent to be determined by the Board and based upon the following conditions:

First, an instructor in Orthodontia in a school satisfactory to the Board.

Second, an associate in the office of an orthodontist whose standing is satisfactory to the Board.

It is, however, definitely to be understood that any person at the time of making application for a certificate shall be in the exclusive practice of orthodontia in his own name.

ALBERT H. KETCHAM, President,
1232 Republic Building,
Denver, Colo.

OREN A. OLIVER, Secretary,
1101 Medical Arts Building,
Nashville, Tenn.

New York Society of Orthodontists

The eleventh annual meeting of the New York Society of Orthodontists will be held at the Hotel Commodore, New York City, on Wednesday and Thursday, March 9 and 10, beginning at 9:30 A.M.

All physicians and dentists who are interested are cordially invited to attend.

CHARLES A. SPAHN, President,
FRANKLIN A. SQUIRES, Secretary-Treasurer,
Medical Centre,
White Plains, N. Y.

The Eastern Association of Graduates of the Angel School of Orthodontia

The next meeting will be held at the Lord Baltimore Hotel, Baltimore, Md., on Saturday, January 30, 1932.

B. W. WEINBERGER, Secretary,
119 West 57th St.,
New York City.

St. Louis Dental Society—January Meeting

The St. Louis Dental Society has been very fortunate in securing Dr. Martin Dewey of New York as the guest speaker for the January meeting at Statler Hotel, January 11, at 8 P.M. His subject will be "National Publicity as Planned by the American Dental Association."

Pacific Coast Society of Orthodontists

The 1932 meeting of the Pacific Coast Society of Orthodontists will be held at the Palace Hotel in San Francisco, February 18, 19, and 20, 1932. A most interesting scientific program and an entertaining social program are being prepared. They will be discussed more fully in the January issue.

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¹Billings, J. S.: *Our Medical Literature*, Trans. VII Intern. Med. Congress, Lond., 1: 54-70, 1881.

²Mayer, Emil: *Medical Literature and its Preparation*, Med. Record, N. Y. 87: 1019-1021, 1915.

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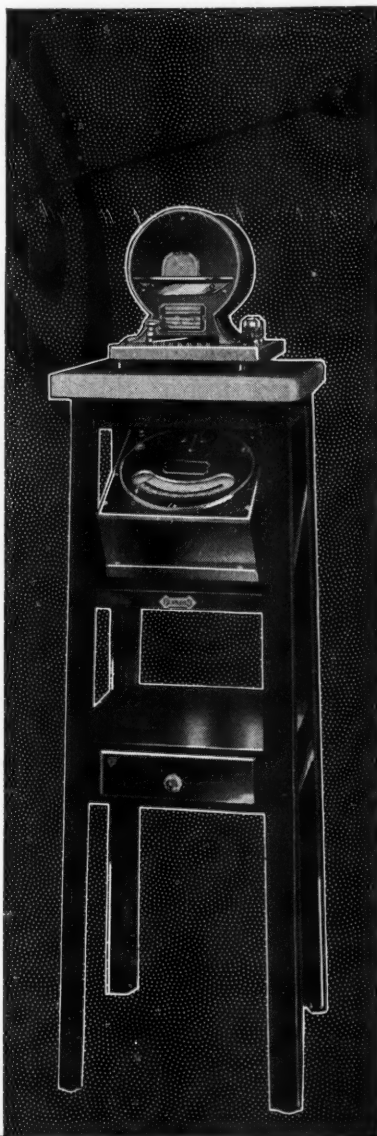
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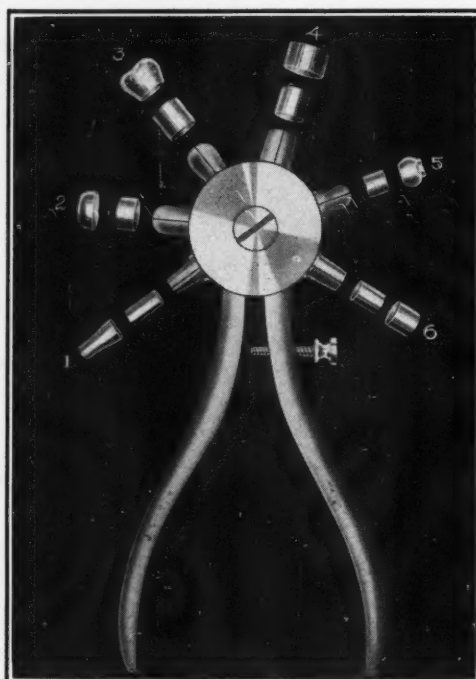
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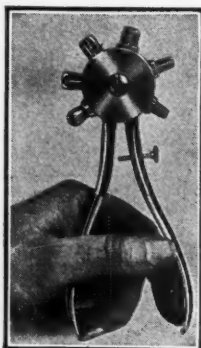


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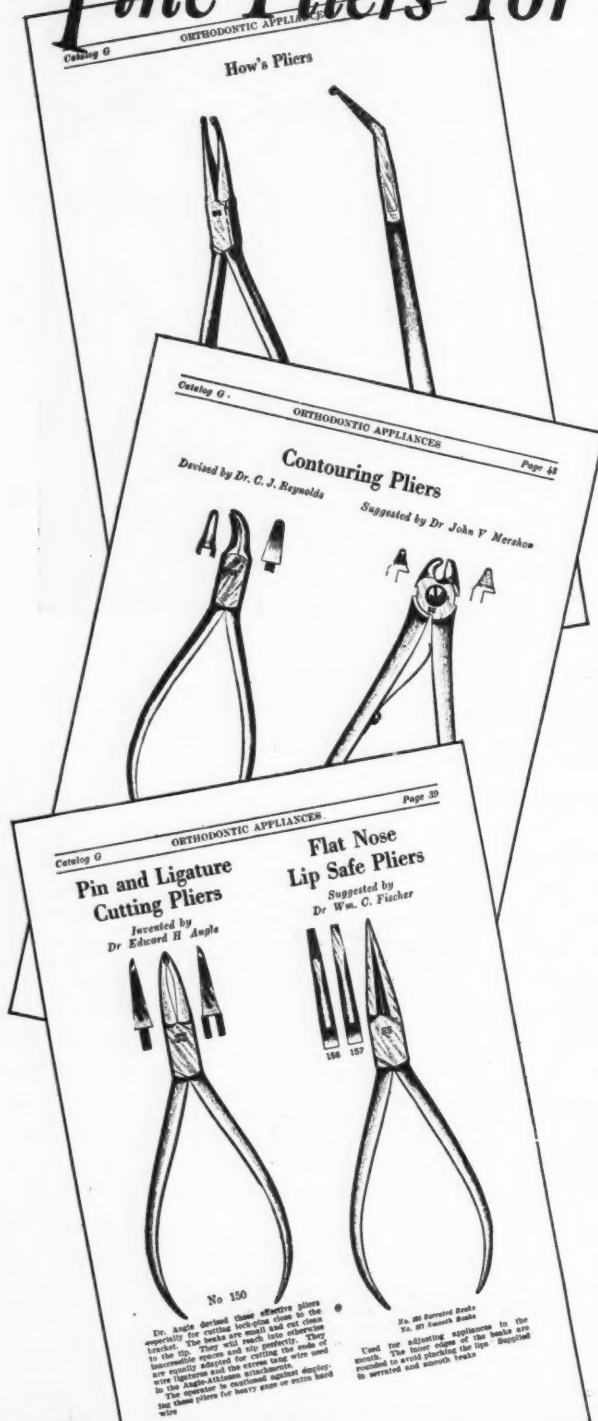
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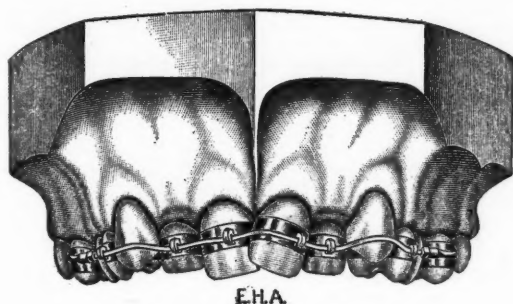
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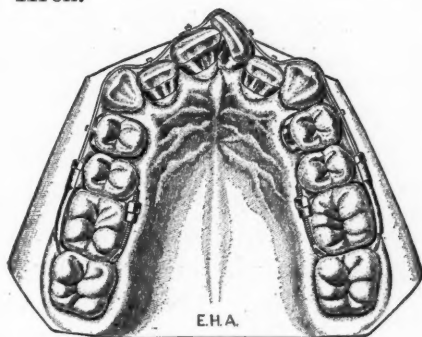
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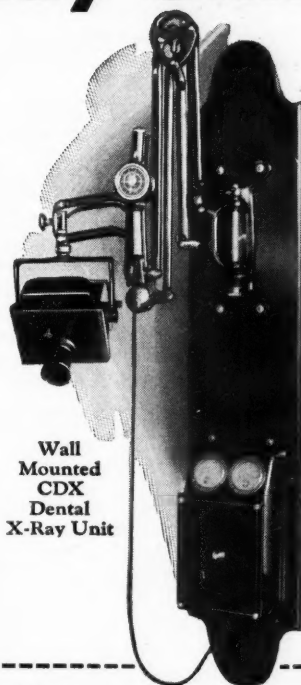


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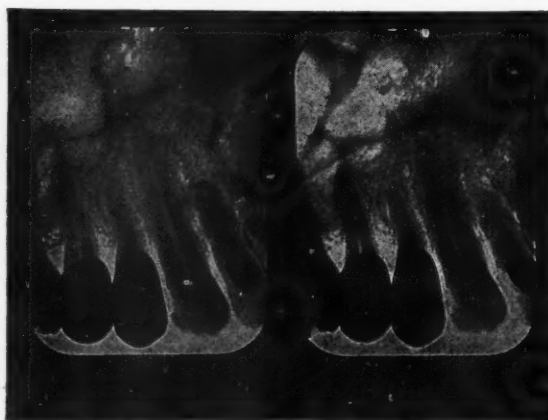
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VOL. XVII

ST. LOUIS, DECEMBER, 1931

No. 12

ORIGINAL ARTICLES

THE DYNAMICS OF THE NEW ANGLE MECHANISM, AS OBSERVED BY A NON-ANGLE MAN*

BY RALPH WALDRON, D.D.S., F.A.C.D., NEWARK, N. J.

THE necessity of making orthodontia a true science and an art was realized by that genius, Dr. Edward H. Angle, because of the great prevalence of malocclusion exhibited in the entire civilized world of his day. He was the first man who realized that if orthodontia was to become worthy of the name of a science, it must have the whole and undivided attention of those who were to practice it successfully, and with this idea foremost in his mind, he became the first man to organize a postgraduate school of orthodontia, not founded for profit but a school where orthodontia could be taught to those who were willing to spend the time and energy required to learn what was then known of this subject.

A review of the earlier records shows that this truly great man, like all of the truly great, had his opponents. For we all know, in order to avoid criticism, one must *be* nothing, *do* nothing and *say* nothing. But Angle was not of this kind, he *was* something, he *did* something and he *said* something. Therefore he was criticized, and sometimes unjustly so.

However, his most severe critics must all admit that he never prostituted his school for profit, that he always worked for the ideal, he was a great enthusiast, which is a necessary requisite for a great teacher. He was a real student, and an observer, which is evidenced by his classification of occlusal malrelations, and his memorable book, "Malocclusion of the Teeth," although written prior to 1907, contains much that has not been improved upon, and little that has been disproved since its publication.

*Presented at the Thirtieth Annual Meeting of the American Society of Orthodontists, St. Louis, Mo., April 21-24, 1931.

I do not wish to convey the idea that orthodontia has not progressed since the publication of Angle's seventh edition, nor that there have been published no other good books on this subject, for there have been several, some of which have been written by members of this Society and which have contributed much to our stock of knowledge.

It is possible that orthodontia has progressed more in the last thirty years than in all the rest of its previous history, and this in no slight measure, has been due to Angle, and the stimulus he gave to his students and others by his

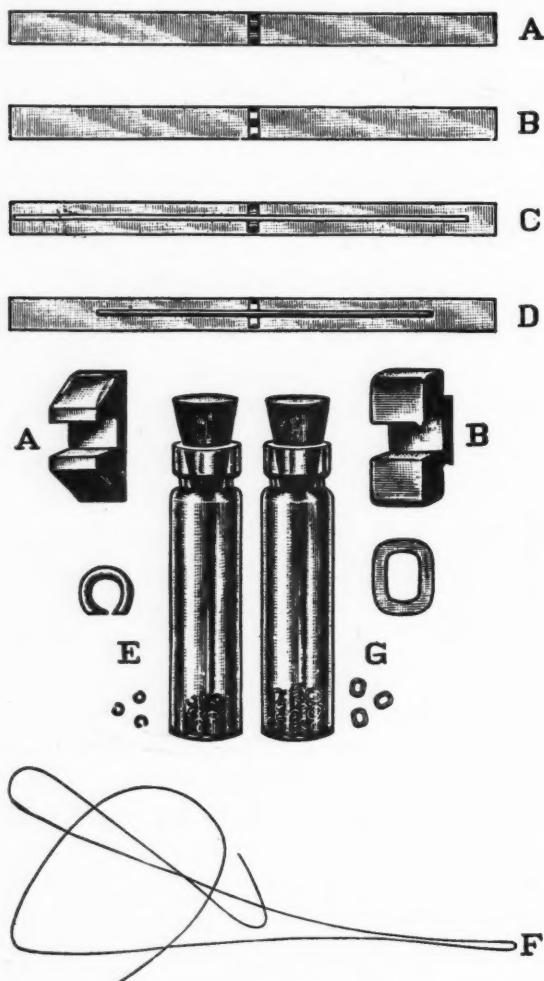


Fig. 1.

enthusiasm in this, *his chosen field*. He wrote no less than thirty-four papers on this subject, and a textbook which went through seven editions and which is today a much valued reference work.

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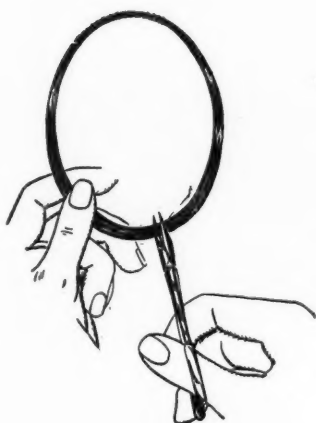
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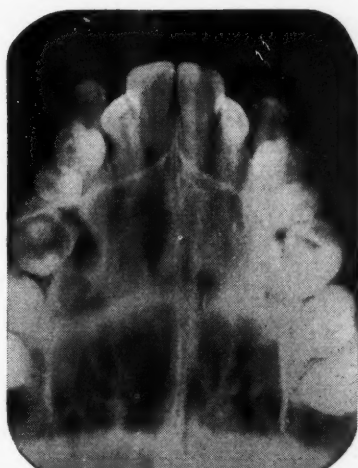
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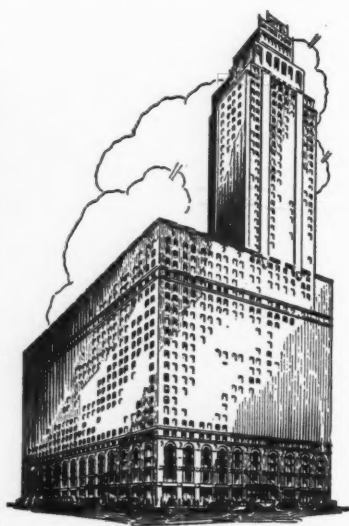
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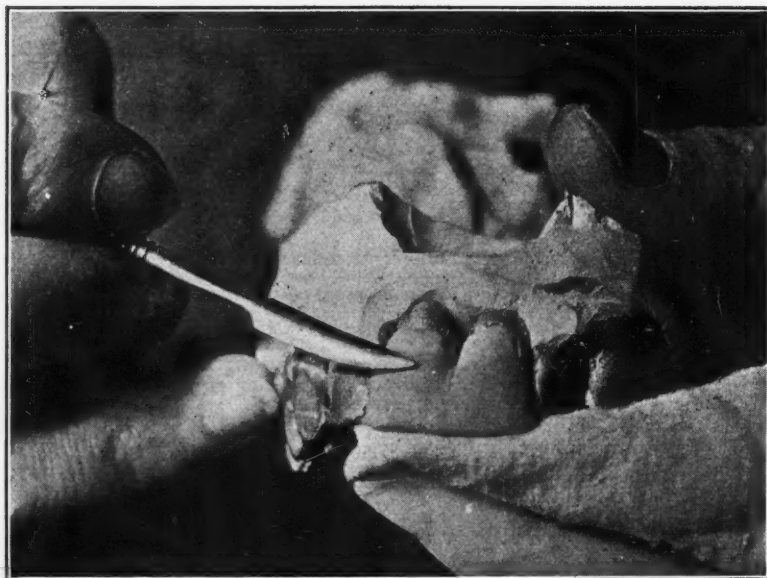
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